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To His Excellency ... 1888, 1890

Annual report of the Territorial Engineer to the Governor of Wyoming, <2nd (1890)>

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SECOND ANNUAL REPORT

OF THE

TERRITORIAL ENGINEER

TO THE

GOVERNOR OF WYOMING,

FOR THE

YEAR 1889.

Cheyenne, Wyoming:
BRISTOL & KNABE PRINTING COMPANY.
1890.

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CHEYENNE, Wyo., November 30th, 1889.

To His Excellency, Francis E. Warren, Governor of Wyoming;

SIR—I have the honor to submit herewith the following report of the operations of this department from the date of its organization in April, 1886, to November 30th, 1889, together with such comments on the workings of our present laws and suggestion as to future legislation as will, I trust, aid in securing more efficient supervision of the public waters and the promotion of the industrial interests connected therewith. I am, very respectfully, your obedient servant;

ELWOOD MEAD,
Territorial Engineer.

INTRODUCTION.

IMPORTANCE OF IRRIGATION.

The reclamation of the arid domain by the aid of irrigation, and the securing of means and adoption of methods by which the work can be successfully accomplished is one of the most important industrial problems now confronting this country. Not only does the agricultural value of two-fifths of the whole country depend on its success, but the location of the arid belt, its climatic advantages and mineral resources all lend added interest and importance to the work which is to make it the self-sustaining habitation of man.

CHARACTER OF THE ARID BELT.

In geographical position, it stretches from the northern to he southern boundaries of the country and separates the humid district of the east from that lying along the coast line of the Pacific. Until made habitable and productive this region must remain an unprofitable territory for all trans-continental railway lines and the losses here sustained are added burdens to the traffic of other sections that must cross it. It has a climate unequalled elsewhere on the continent for its stimulating and invigorating qualities and which for many invalids furnishes the only means of prolonging life or restoring health. Within its limits are found our principal deposits of precious metals and immense bodies of useful minerals. The development of these resources and the comfort and well-being of those engaged in the work is largely dependent upon the securing of a cheap and abundant food supply, which can only be accomplished through its being produced n the locality where consumed.

IRRIGATION A NATIONAL PROBLEM.

It is thus apparent that the success of irrigation is not only a question of vital interest to the states and territories dependent upon it for their agricultural wealth, but is also in the widest sense a subject which has for the whole nation the most direct interest and importance. The immense extent of our country and the large areas of unoccupied land to the east of it has hitherto prevented the recognition of these facts by the country at large, but the recent interest shown in the subject and the dissemination of information through the congressional investigation recently completed, promises to result in the formation of more just conceptions as to the needs and resources of this region and to lead to the hope that we are just entering upon an era of rapid and prosperous development of our irrigation resources.

DEVELOPMENT IN THIS TERRITORY.

Wyoming differs from nearly all the commonwealths of the arid region in the fact that its settlement and development is not the result of mining excitements and discoveries. The chief employment of her people has been and is yet the care and management of the grazing and farming interests. To this fact is due the surprising agricultural development which has taken place within the past decade. Handicapped as the territory has been by the lack of transportation facilities, the enormous expenditure involved in the construction of our irrigation works would not have been met save through the proceeds of the cattle business and the necessity arising therefrom for a winter's food supply. As it is Wyoming, although the youngest territory in the Union, stands third in the area of irrigated land and in the number and mileage of irrigation canals. Or to state it differently, it shows an area of farming land greater than the average of the New England states and an irrigated territory equal to one-half that of Italy and greater than that of France and Spain combined. This is an extraordinary record when it is remembered that it is largely the work of the past ten years, under very unfavorable conditions, and should forever put at rest all questions as to the ultimate greatness or wealth of this commonwealth. If the pioneers of this work can produce such results what may not be accomplished through the intervention of ample capital or of state or national aid?

With Wyoming, as with the remainder of the arid belt, the construction of ditches and the utilization of their waters has been in advance of legislation for the regulation and protection of the various interests connected therewith. This has resulted in unavoidable injustice and hardship in some cases and has greatly increased the gravity and difficulty of inaugurating, and putting in operation, a system for properly regulating the division and use of the public water supply.

LACK OF EFFECTIVE SUPERVISION.

The most unfortunate feature, however, is the fact that the location and manner of construction of ditches has been left entirely to the inclination or financial resources of the settler. There has been no preliminary control of the streams and the waters have been diverted in a haphazard fashion, rather than in pursuance of a definite policy, having for its end their full utilization and economical distribution. As a result, while we have many works of an excellent character, leaving in their admirable design and substantial construction nothing to be desired, considered as a whole the result is far from satisfactory. In many instances defective works make the utilization of the waters wasteful and expensive. In others, wrong locations and excessive appropriations make the proper supervision and control by the state extremely difficult and expensive. These evils will in time undoubtedly disappear but they could almost wholly have been obviated by the exercise on the part of the territory of an intelligent preliminary supervision over the location and construction of all irrigation works.

While the advantages of such supervision have long been apparent to all who are familiar with our situation, the reasons for delay in its being undertaken have been numerous and important; they are found in the character and previous training of the people and in the nature of our territorial government. In the first place, our agricultural population are descendants of people inhabiting the most important humid districts on the globe, and whose whole previous training and inherited traditions led them to look with disfavor on any restrictions or control of the use of water. The part that the inherited idea that water was public property to be seized and used in any manner or at any place which inclination or profit might dictate has probably ha much to do with the delay in providing needed safeguards, a well as leading to the evasion and disregard of the laws alread in existence. Experience has, however, shown the fallacy o such ideas and the dangers incident to neglecting the properl protected vested rights or to supervise the disposal of the commodity on which so large a share of the future prosperity of th territory will depend.

THE PRESENT A TRANSITION PERIOD.

There is every reason to believe that we are now at a turning point in the history of this interest, not only in this territor but throughout the arid belt, in which the unaided and, in man cases, misdirected efforts of individuals are to give way to work constructed according to systematic plans having for their obje the economical distribution of water and the reclamation of th largest areas of land.

We are fast coming to realize that agricultural values inher in the water rather than in the land which it reclaims, and wit this knowledge is the conviction that more efficient supervision i required in its disposal and utilization. Important national measures are now under consideration having for their aim the improvement of methods and the furthering of the full and rapi development of our agricultural resources. Local governmen are taking more efficient steps for protecting and securing th proper use of one of the most important resources and there an increased interest in the subject on the part of the public large. The prospective admission of Wyoming to stateho gives the subject unusual importance. With the adoption of constitution there comes a stability to the measures adopted b the local government not before obtainable. The provisions o this subject in the constitution just adopted contain a number o features which distinctly mark the advanced views now prevai ing and their early inauguration will undoubtedly greatly stim late the development of our agricultural resources.

AGRICULTURAL RESOURCES.

SUCCESS OF IRRIGATION. ITS CHARACTER IN WYOMING. WATER SUPPLY. MEASURES FOR UTILIZING THE SURPLUS.

To the general public Wyoming has been a country of lofty mountains, sage brush deserts, with extensive cattle ranges and immense and valuable deposits of useful metals and minerals. The popular conception has not hitherto classed it among the important agricultural districts. This, however, is rapidly being changed. The results already achieved and the opportunities for further development which it affords places its coming agricultural wealth and importance beyond question.

As the lack of information as to the territory's resources has in many cases led to unfavorable or mistaken opinions, a brief review will be given of the physical and climatic features which characterize and govern its agricultural possibilities; dealing only with their general character rather than attempting any detailed description of the resources and prospects of particular localities. The latter data, though valuable, is beyond the limits of this report, and is also impossible from the fact that as yet I have not the necessary personal knowledge of many important and promising irrigation districts to properly describe them.

In the first place the territory is dependent, with the exception of a few localities along the eastern border, upon the aid of irrigation for the successful growth of crops. In the excepted areas the rainfall records show a marked increase over the average for the territory. For example, Hat creek in Converse county shows an average annual rainfall of 17.26 inches while the territorial average is less than 12. inches. Crops are also successfully grown in portions of Crook, Converse and Laramie counties by rainfall alone but it is to irrigation that we must look for the largest yields and the most certain returns, while in all but a few restricted localities its aid is simply indispensable to the securing of profitable returns. Owing to the limited area in which farming is possible by the aid of rainfall alone it may be disregarded and our estimate of the future agriculture of the territory confined to that which will probably be reclaimed through irrigation.

In making this estimate we may safely consider that past experience has fully established the following facts:

First. That any land which can be supplied with water becomes enormously productive, rendering the agriculture of this section remunerative to a degree rarely achieved in regions dependent upon rainfall.

Second. That the area of agricultural land largely exceeds the water supply, making it certain that some of the land must forever remain in its present condition and causing the agricultural value to inhere in the water rather than in the land.

In determining the possible extension of the irrigable territory the controlling factors are, therefore, the amount of our available water supply and the quantity required for irrigating an acre of land.

As to the second of these, the limit of the successful growth of crops by the aid of rainfall alone has been placed at an annual precipitation of twenty inches but in the arid region the excessive dryness of the air and the diminished pressure of the atmosphere consequent upon its elevation leads to a more rapid evaporation, and requires the supplying of more moisture. The amount required varies greatly with the soil, crop and skill of the irrigator, making the fixing of an approximate average exceedingly difficult. Taking, however, the measurements made by this office during the past year and the results of experience and observations in Colorado I am confident that covering the ground by irrigation with a layer of water two feet in depth will, in addition to that received from rainfall, fully equal the average demands of a cultivated crop and, since much of the water so used returns to the stream as waste water and seepage, the taking of this as a standard gives an amount rather above than below the truth

AVAILABLE WATER SUPPLY.

In fixing the volume of the available supply we have to depend on sources outside of actual stream gaugings; the limited number of these not permitting of any deductions being made therefrom and in determining this question we must resort to the records of rainfall by which the streams are filled. This is furnished in the records of observations of the regular and volunteer observers of the signal service in this territory during the past twenty years.

From these records it seems probable that the insufficient rainfall is not due to an inadequate supply, taking the territory as a whole, but to its unequal distribution. If the moisture of the atmosphere was precipitated uniformly over all portions it is probable that irrigation could be dispensed with. This, however, is not the case. The ranges of mountains reaching from our southern to our northern boundary act as great condensers and clouds in passing over their summits are deprived of a great part of their moisture, resulting in an insufficient rainfall on the plains beyond. From the records of the signal service, which embraces nearly every portion of the territory, the average annual precipitation on the plains varies from 8.50 to 17.26 inches, the average for the whole being about 12.00 inches. The supplemental supply which fills the streams and meets the needs of irrigation comes very largely from the mountain areas, as it is there that the streams have their origin. The statistics of mountain rainfall are not so complete as those of the plain but those of the signal service at Pike's Peak in Colorado (33. inches), observations of the Colorado state engineer, 1884, and reports of the snowfall in Yellowstone park region lead me to believe that the average precipitation for the principal mountain ranges of the territory is fully three feet. It is less on some of the minor ranges, but the average is probably thirty inches for the whole of the mountain water sheds of our streams. There are over twenty million acres of this mountain area, which covered to an average depth of thirty inches gives a total of over fifty million acre feet on these water sheds each year. A large part of this is lost through evaporation and in sinking into the subterraneous channels, but taking into consideration the character of the soil on which it falls and the declivity of the surface of the mountain sides it is probably a fair estimate to regard one-third as available for irrigation, (the report of the state engineer of Colorado for 1888, page 19, shows, from observations, forty per cent available). This shows the total discharge of our streams as derived from the mountain area alone and available for irrigation direct, or for storage purposes, as equal to twenty million acre feet which on the duty before mentioned would suffice for the reclamation of fully ten million acres. The problem of irrigation is, therefore, to supplement the work of nature and distribute the surplus water of the mountains over the thirsty plains. It is probable that the waters of two of the streams of the territory will not all be utilized within its borders, on the other hand much of the water once used will find its way back to the stream and do service over again, hence it is that with our present information all attempts at fixing the the future extent of the irrigated territory must be largely speculative. Much will depend on the future governmental action tending to secure economical distribution and the storage of waters which now run to waste.

NATURAL DISTRIBUTION OF WATER SUPPLY.

The location of the different mountain water sheds secures an exceptionally favorable distribution of the water supply. Streams flow in all directions and penetrate every section of the territory. It is the best watered portion of the arid region. Recorded irrigation ditches now divert water from over six hundred streams and if our statistics were complete the number would be largely increased.

NATURAL DIVISIONS.

The territory is now divided by law into nine water districts but, considering the natural features alone, the streams constitute four natural divisions or drainage systems, each complete in itself and totally distinct from the others. A tabular summary giving the boundaries, principal streams and areas of each is given below:

No.	Location.	Principal Streams	Area, Square Miles	Water districts embraced
1	Drainage of Platte river.	North Platte, Sweetwater and Laramie rivers.	24,746	Nos. 1. 2, 3 and unorganized.
2	All that part of the territory north of Platte river drainage and east of Big Horn mountain.	Belle Fourche, Cheyenne, Powder, Crazy Woman and Tongue rivers. Clear, Piney, Goose and Wolf creeks.	23,302	No. 6 and part of No. 5.
3	Drainage of Big Horn river	Big Horn, Wind, Popoagie, Gray Bull, Stinkingwater and No Wood rivers.	(A) 19,991	No. 8 and part of No. 5.
4	Drainage of Green, Bear, and Snake rivers.	Sandy, New Fork, Fontenelle, La Barge, Ham's Fork and Henry's Fork, tributaries of Green River; Salt, John Day's river and tributaries of Snake river.	26,389	Nos. 4, 7, and unorganized.

(A) Does not include Yellowstone Park.

VALUE OF GRAZING LANDS.

Irrigation in Wyoming has certain peculiar features which distinguish it from that of Colorado, in fact from any other arid commonwealth. This is due to a number of causes, the most important of which are, the character of many of our streams and the contour of the surface along their banks. These influences are destined to be permanent and not only give our agriculture a distinctive character but to greatly enhance the profit and success of certain kinds of farming. Briefly stated, they are as follows:

The valleys of all streams are narrow, scarcely ever exceedin five miles in width. Bordering these are uplands which ar usually considerably elevated, making it expensive to carry wate upon them. In the eastern part of the territory nearly all stream including the minor water courses, are of great length. Hors creek in Laramie county traverses a distance of fully 150 mile From this stream there have been taken over eighty ditches an canals. Dry Cheyenne in Converse county is as long, and thes are simply types of which numerous equally striking illustratio might be given. As a rule their waters can be diverted throughout their entire length, and as the ditches to water the botto lands are of a character, and could be built at a cost, to accor with the resources of our pioneer ditch builders it has resulted i the reclamation of the bottom lands to the almost complete neglect of the upland plateaus. This has brought about the construction of a large number of small canals, each farmer buildin and operating his irrigation works independent of his neighbor The large extent of land thus reclaimed leaves but little surplu of water for the construction of large canals to water the upland hence these as a rule must forever remain what they are now grazing lands, fit only for this use. This extension of the irrigated territory in a narrow strip along the whole length of stream has some serious disadvantages. It is wasteful of wate and renders the supervision of the distribution by the state complicated and expensive. On the other hand it has marked advantages. Farming thus far, of a necessity, has been combine with stock growing. By the extension of the irrigated distric the settler secures ample summer range for his stock on the fre pasturage of the contiguous public lands and he can utilize th whole of his cultivated land for the production of his winter foo supply. In this way the grazing lands are best turned to accoun and their use greatly enhances the profits of the farmer and th productiue value of his land. If the question were one of simpl securing the reclamation of the greatest area, or the most economical distribution of the water supply, or the producing of th greatest quantity of farm crops, it would be solved by the construction of a few large high level canals which would distribu the water over compact areas of cultivated land. Such conside ations would in most cases be of paramount importance but the value and extent of the grazing lands of this territory has heretofore made their utilization one of the most important questions in our agricultural development, and will in the near future, make Wyoming the most important and successful dairy and stock raising district of the mid-continent. Hence on our smaller streams I look to see the combination of farming and stock growing continued, with improvements in our present methods rather than the introduction of radical innovations.

THE SURPLUS WATER SUPPLY.

At present the principal streams of this territory are almost untouched, and it is along their courses that the important grain growing districts will be found in the future. The territory offers great opportunities for the construction of canals to water large areas of farming land, unsurpassed in fertility or in favorable ocation for securing a home market for all that is produced. In a report to the United States Senate Committee on Irrigation I made the following statement:

"The valleys of the Green and the Big Horn rivers offer today the best opportunity for the construction of a system of irrigation works, according to a prearranged plan, of any section with which I am familiar. To a large water supply there is added the total absence of vested rights to interfere with the construction of works which shall utilize the available water to the best advantage and least expense." It may be added that he valleys of nearly all our important streams present favorable opportunities for the construction of large ditches, the magnitude and cost of which has prevented their being undertaken by the pioneers in this work. The plateaus bordering on the North Platte, near Saratoga, the valley of the Sweetwater and of a number of streams flowing east from the Big Horn mountains are destined to undergo a marvelous transformation within the next few years, when the increase in transportation facilities hrough the territory makes these sections known to the world as they are to those who have examined them.

HOW IT SHOULD BE UTILIZED.

Since the ultimate extension of the cultivated area will depend on the water supply, measures should be taken to secure its proper distribution and economical use and, since all the lan cannot be reclaimed, care should be taken in the building ditches that they be so located as to water only the best.

An important, if not indispensable aid to this, is an examination of the lands along our important streams to locate the mos valuable irrigable areas and sufficient stream gaugings and measurements of the sources of supply as will give an approximat estimate of its amount. Possessed of this information the prope location of the ditches and the size and number required for th best utilization of the water supply could easily be determine The next step would be to require all ditches to be located an constructed in accordance with the result of the surveys an limiting the number to the ascertained capacity of the strea Such action would result in a greatly diminished cost of distributing works and a large extension of the irrigated territory. I would secure the reclamation of the most desirable lands and b preventing the construction of surplus canals the conflict an abuses now resulting from over appropriation of streams wou be avoided. The necessity for such action and control becom every year more apparent. Every consideration which led t the abandonment of the haphazard methods of defining the boundaries and disposing of the public lands, which prevailed in th early history of this country, applies with greater force in requiring the adoption of a system and method in the disposal of th public water within our borders.

At the present time the subject is complicated and loc action is embarrassed by the limitation imposed by our territori condition and by all the public lands being under the control the national government. It is useless for the territory to tak any steps toward securing a systematic irrigation developme unless it can also control the settlement of the land. The control of the land by one authority and the water by another in measure paralyzes the energies of the local authorities and make it indispensable, if we are to have the utmost prosperity, that on of two steps should be taken by the national authorities, eith the control of the land should be turned over to the local government, or congress should extend proper aid in the construction works for their reclamation. The present irrigation survey the national government is an important beginning and the character and experience of those in charge of the work is a guarantee of its efficiency and success. To accomplish the greatest good, however, it should be enabled to extend the prosecution of the work and bring it to a speedy conclusion in order that the valuable information thus procured may be utilized in the future work.

SUMMARY OF IRRIGATION DEVELOPMENT BY DISTRICTS:

District.	Total number of recorded ditches	Total length as stated.	No. claims with statement of length omitted.	Total capacity as given. Cu. ft. per Sec.	No. ditch claims omitting statement of capacity	Total acreage watered as given	Nunber of ditch claims omitting statement of acreage.
1	643	1322 385	39	5911.584	48	482434 00.	89
2	389	698.703	38	7960.354	70	418329.64	75
3	457	575.972	139	6371.755	111	451424.00	173
4	75	174.01	20	553.45	51	64280.00	34
5	502	996.398	32	10422.70	57	440540 00	50
6	124	196.955	46	1556 325	36	58162.00	55
7	322	518.24	50	1658 905	96	108976.78	95
8	182	212.41	52	3059.487	79	35395.00	96
9	49	91.43	1	342.000	25	42460.00	3
C	7	11.905		136.8		4180.00	
Total.	2750	4798 408	417	24973.36	573	2106181.42	670

WATER DISTRICTS.

District.	Total area (acres.)	Area now irrigated (acres.)
No. 1.	9,123,840.	482,434.
No. 2.	5,446,656.	418,329.64
No. 3.	4,854,988.8	451,424.
No. 4.	5,289,984.	64,280.
No. 5.	13,999,104.	440,540.
No. 6.	3,796,992.	58,162.
No. 7.	4,405,248.	108,976.78
No. 8.	4,737,945.6	35,395
No. 9.	340,992.	42,460.
Unorganized	5,010,739.2	4,180.
Unorganized	4,727,808.	
Total.	61,734,297.6	2,106,181.42

HISTORY OF THE OPERATIONS OF THE ENGINEERING DEPARTMENT,

From April 1st, 1888, to November 30th, 1889.

EXAMINATION OF THE TERRITORY. GAUGINGS. INVESTIGATION OF THE DUTY OF WATER. COLLECTION OF DITCH STATISTICS. SUPERVISION OF THE DISTRIBUTION, ETC. UNITED STATES IRRIGATION SURVEY.

The law creating the office of territorial engineer contains the following provisions as to his duties:

"SEC. 2. The territorial engineer shall have general supervisions of the diversion and division of the water of the various natural streams in the territory, and shall have supervision o the work of the water commissioners of the different districts o the territory, and shall do and perform any and all work for the territory which comes within the nature of his profession as a engineer, when called upon by the governor to do so.

"SEC. 3. The territorial engineer shall make, or cause t be made, careful measurements and calculations of the maximum minimum and ordinary flow, in cubic feet per second of time, o the waters flowing in each stream from which water shall b drawn for irrigating purposes, commencing such work upon those streams most used for irrigation; he shall collect facts and make a report as to a system of reservoirs for the storage of waters, i those portions of the territory where such a system is practicable stating in such a report the location, capacity and cost of such reservoirs; he shall become conversant with the water ways o the territory, and needs of the territory as to irrigation matters and in his report to the governor he shall make such suggestion as to the amendment of existing laws, or the enactment of ne laws, as his information and experience may suggest; and h shall keep a full and proper record of his works, observation an calculations, all of which shall be the property of the territory."

Being the first incumbent of the office, it devolved upon m to devise the methods of carrying out the provisions of the law and of putting into operation the laws providing for the supervision and control of the public waters. There was some difficulty experienced in this at first. Previous legislation had provided for the recording of ditches but these records were scattered throughout the territory and were not available. Several water commissioners had been appointed but all were without proper information and instruction as to their duties. The rights of different claimants to water had only been determined, as required by law, in one instance, that of Crow creek, while there were soon calls for decisions and for the exercise of whatever authority I possessed from all parts of the territory.

DITCH RECORDS.

It soon became manifest that I must have at my command a knowledge of the location and character of the ditches already built, but to obtain this required an examination of the recorded statements in the offices of the various county clerks. This work was begun at once and has been carried to completion, the aid of the county clerks having been obtained in three instances in making an abstract of the record. It has proven a serious undertaking. Not only did the number of ditches largely exceed my estimate but the recording of many of the earlier statements among the miscellaneous records rendered their examination tedious and difficult.

In order to facilitate the examination of the record in this office the statements as given in the abstracts were rearranged so that all the ditches diverting water from a particular stream were grouped together, being arranged in the order of their priority of claim. The list as completed is given in another portion of this report. As there has been no opportunity of comparison with the original statement, it is undoubtedly defective and doubtless a considerable number of ditches have been omitted. As it is the desire to have the record as nearly correct as possible, I shall be pleased to have any matter of this kind brought to my notice.

Some ditch claims were purposely omitted since, owing to their defective character, they were of no value. As it is, the incomplete character of many statements renders it impossible to make a correct tabular summary of our irrigation development. Not only were many of the recorded statements incomplete but the diversity existing in their forms and arrangement of facts set forth greatly increased the labor of their examination. Becoming impressed with the advantages which would result from the adoption of a standard form of claim throughout the territory, I entered into correspondence with the various county clerks on the subject, which resulted in the adoption of the form shown hereafter (it being already in use in three counties of the territory) and a copy was mailed to each county clerk and county surveyor with this letter:

"*To the Appropriators of Water:*

"An examination of a large part of the claims to water, now on file in the offices of the various county clerks of the territory, has disclosed the fact that a wide diversity exists in the character of the statements contained in these claims. This is shown in the different orders in which the essential facts are arranged; in the use of different units to designate the volume of water claimed and in the various forms in which the dimensions and grades of the ditches are expressed. The lack of uniformity proves a source of serious annoyance and perplexity to those having occasion to examine the records. To reduce these varying units to a common standard, which becomes necessary whenever any use is made of these records, is a work involving considerable time and labor which could be avoided by the use of a standard form in the original statements.

"Another, and more serious defect which has been observed in these claims, is the failure of many to state all the facts necessary to the determination of the claimant's right or his protection in them. These omissions include nearly every portion of a complete claim, but the most serious and numerous are the failure to state fully or properly the dimensions of the ditch or the volume of water claimed. The unit employed for the latter is often so indefinite as to be practically valueless. Claims for "square inches," "agricultural inches," "California inches," or "miner inches," are decidedly out of place in this territory where the law recognizes no unit except the "cubic foot per second." These incomplete statements are destined sooner or later to prove a source of serious annoyance, if not expense, to the parties filing them, since, whenever an adjudication is had, the missing facts will have to be supplied.

"As an aid to secure the proper filing of these claims in the the future and the consequent protection of the rights and interests of the claimants, I have prepared a standard form, the use of which throughout the territory is strongly urged. The advantages of uniformity and system, to be secured by this means, are so many and important that it is hoped that this request will, in all cases, be complied with. Copies of this form have been furnished to all the county clerks and county surveyors of this territory, who will doubtless make arrangements for their being readily obtained."

This form or one substantially like it is now in use in every county in the territory and in a number of cases the county clerks have had books prepared with blank forms similar to the statements. The improvement over the former system has been marked, marred by the fact that imperfect statements, if presented, must be recorded, the law giving the county clerk no power to examine and reject for cause.

So far, however, as their authority and knowledge of the subject has extended, it has been exerted for the improvement of the record, and I wish to express at this time my personal obligation to these officers and to warmly commend their efforts in behalf of the irrigator. As far as the present laws permit some of the records are models and in one county (Uinta) a complete abstract of the claims now on file has been made.

STATEMENT OF CLAIM TO WATER RIGHT.

THE TERRITORY OF WYOMING, }
COUNTY OF .... }

I, ..., being duly sworn according to law, on my oath say:

1. The name of the ditch for which an appropriation of water s claimed is the .... ditch.

2. The name and postoffice address of the owner of said ditch are as follows, to-wit: ....

3. Said ditch is situated in Water District Number ...., n the County of .... in the Territory of Wyoming,

4. The headgate of said ditch is located.................................. and the general course of said ditch is ... .

5. Said ditch draws its supply of water from said

6. The length of said ditch is .. .. miles ....

7. The width of said ditch is .... feet at top , and....... feet at bottom.

8. The depth of said ditch is .... feet.

9. The grade of said ditch is .... feet per mile .....

10. The carrying capacity of said ditch is .... cubic feet per second of time.

11. Work was commenced on said ditch by original construction .... on the .... day of . . . A. D. 18

12. Water was actually appropriated therefrom for irrigatio and other beneficial purposes on the day of . A. D. 18

13. There are . .. acres of land lying under said ditc and being proposed to be irrigated by water therefrom.

14. A map on a scale of one inch to the mile, showing the location and route of said ditch, the natural stream from which i draws its supply of water, and also the legal sub-divisions o land through which they flow, is found on the reverse side o this sheet, and is made a part of this statement of claim.

15. The owner of said ditch ha constructed the same fo irrigation and other beneficial purposes, intending to use and appropriate water from said .. . . for such purposes; and this statement of claim is made for th purpose of complying with the provisions of an act of the Council and House of Representatives of the Territory of Wyoming entitled: "An Act creating the office of Territorial Enginee and concerning the appropriation of water," approved March 8 1888.

....

TERRITORY OF WYOMING, } ss.
COUNTY OF ....

I hereby certify that the foregoing Statement of Claim wa signed in my presence and sworn to before me by........................ this .... day of .... A. D. 18.....

....

....

FIELD WORK.

The greater portion of the summer of 1888 was devoted to the gauging of streams and to an examination of some of the more important irrigation districts. A wagon and camp equipage was procured and in company with my assistant, Mr. Geo. H. Keeney, I took the field in the latter part of May and continued this work until the middle of August. The journey covered a distance of about 1,500 miles and included an examination of a large part of Albany, Laramie, Johnson and Sheridan counties and the southwestern portion of Converse county. The object of the journey was to obtain a personal knowledge of the more important streams; of the country through which they flow and of the character ot the distributing works for utilizing their waters.

GAUGING RECORDS.

A large number of streams were gauged but in many cases the results obtained will only be valuable for comparison with the subsequent observations and cannot be taken as showing the total capacity of the stream. To determine this will, in many cases, be a difficult matter, since if the gauging station is placed above all ditches diverting water it will often omit important feeders of the stream, while if placed further down the effects of the depletion by high line canals has to be considered. To illustrate this, the measurements made on Horse creek in Laramie county will be given. These measurements were made in the spring of 1888 during an unusually dry period. All the water that could be taken was diverted from the stream by each ditch, resulting some places in the complete diversion of the stream. Measurements were made at five points, going down the stream, the first being at the head, immediately below the junction of the tributaries which form it. The distance between the first and second was five miles, between the second and third was twelve miles, between the third and fourth was twelve miles, between the fourth and fifth sixteen miles, making the total distan between the first and last measurement forty-five miles. Belo is given a table showing the date of the gauging, the locati where the measurements were made and the volume of water i the stream:

DATE.	POINT WHERE GAUGED.	DISCHARGE IN CU. FT. PER SE
May 15, '88.	Near head of main stream Sec. 30, T 17, R 69	10.00
May 16, '88.	Dyer's ranch, Sec. 23, T 17, R 69	2.82
May 16, '88.	Flume at Carey's ranch, Sec. T , R ,	2.10
May 17, '88.	J. H. D. ranch, Sec. 34, T 18, R 65	5.00
May 18, '88.	Head of Gordon ditch, Sec. 4, T 18, R 63	30.00

An examination of the map of Horse creek accompanyin this report will show the following facts: Between the first an the last measurements the stream has no tributaries of any importance, while above the point of the first measurement the are twenty-four ditches, nearly all of which were using wate and that between the first and the last measurements there we twenty-six ditches, the greater portion of which were usin water at that time; yet we have the surprising phenomenon o three times as much water at the last measurement as at the firs The question at once arises as to its source. In answer I woul say it comes from two sources, the first being the springs alon the stream fed by underground channels from the mountains an the second is the return to the stream of the seepage water fro irrigation.

It will be seen from the above that a gauging record at an single point on this stream would have comparatively little valu in showing its irrigating capacity. It also serves to show some thing of the complications and perplexities which beset the wate commissioner in attempting an equitable division of the water o our streams. Unless, therefore, the gaugings of our streams ar conducted with judgment and a thorough understanding of th conditions throughout their course the result is very apt to b misleading; and as the time at my disposal would not permi me to make many investigations of this character the gaugin record for the year 1889 has been confined to the Laramie river, one of the most important streams of southern Wyoming.

NORTHERN WYOMING.

Johnson and Sheridan counties have at present the most land under cultivation. The lack of transportation facilities continues to act as an obstacle to their development and will until overcome by the construction of a railway into that region. With such a communication with the outside world a large portion of northern Wyoming is destined to be reclaimed, since it is favored with a mild winter climate, a fertile soil and an unusually abundant water supply. The surplus waters of the streams of Johnson and Sheridan counties are alone sufficient for the irrigation of half a million acres.

OVER APPROPRIATION.

On many smaller streams of the eastern part of the territory the water has been over appropriated. Streams whose small discharge and irregular flow makes them of little value for the purpose of irrigation have been completely absorbed by a few ditches. These streams, from their location and great length, have been of great importance in supplying water for stock grazing on the public lands. Should these streams be dried up, the contiguous grazing lands must be abandoned with a resulting loss which far exceeds the value of the agricultural produce arising from the use of the water for irrigation. There should be some way of preventing this, as the water of the streams should be at all times used to secure the greatest public benefit. It is a matter which calls for immediate legislation and will be referred to under that head.

DISTRICT NUMBER NINE.

At the request of Governor Moonlight I made, in the spring of '88, an examination of Salt River Valley, situated in the northern part of Uinta county, the residents having petitioned for the creation of a water district. Although living at that time on unsurveyed lands, the enterprising settlers had constructed twenty-six ditches and canals and had made so much progress in the reclamation of their lands that district No. 9 was created.

CHARACTER OF DITCHES ALREADY CONSTRUCTED.

The majority of the irrigation works of the territory are owned by parties owning land they reclaim and, while small, are as a rule substantially and well built. I regret to state, however, that one prevailing error in building lateral ditches is manifest. As a rule they follow contour lines without any regard to increased length and loss of velocity caused by the abrupt bends thus made necessary. The result is heavy losses from evaporation and an added obstacle to cultivation. More care should be given to this both in the interest of economy and of improvement in irrigation methods.

There are also a large number of works worthy of commendation either from their size and cost or from the excellence of their design and construction. I cannot of course mention all, but among others is a tunnel diverting the waters of Piney creek into Prairie Dog. The ditch and tunnel of Gordon & Campbell on Horse creek and a number of ditches diverting water from the Laramie river, among the latter may be mentioned:

NAME.	AREA WATERED.	COST.
Pioneer Canal	50,000 acres	$ 50,000
Boughton Canal	10,000 acres	50,000
Wyoming Development Canal	58,000 acres	485,000
Brown Ditch	10,000 acres	

The Wyoming Development Company's canal ranks among the important irrigation works of the whole continent, not only in the size and cost, but in the originality of its plan. The water is diverted from the Laramie river about fifty miles from where it is used by means of a tunnel 2,380 feet long, through a mountain, and which empties the water diverted into a stream running parallel to the river. From this stream it is caught by a system of main canals aggregating 100 miles in length. This system of works waters one of the finest bodies of land in southern Wyoming, but although completed in 1886 has been almost unused owing to complications involving title to the land. This is most unfortunate, not only to the parties constructing these works but to the territory at large. If these lands had been promptly brought under cultivation it would not only have added largely to our agricultural population but would have enabled the cities of Cheyenne and Laramie to have obtained a large part of their food supplies at home, thus materially reducing the cost of living in both.

There are some excellent ditches on Bear river, and the western portion of the territory promises to have a rapid agricultural advancement in the near future.

The four rivers which have the greatest discharge, the Platte, Green, Big Horn and the Snake are as yet practically untouched, although important canals are projected from the two first named. On each of these streams there are splendid opportunities for agricultural settlements and for the investment of corporate capital in the construction of irrigation works.

HYDRAULIC MINING.

During the past summer I made a partial examination of the placer mining works on the tributaries of the Sweetwater river. The most important of these belongs to Mr. Emile Granier, proprietor of the Christiana Lake Mining works. The gravel beds which are being washed are situated on Rock creek, the water being brought in part from reservoirs situated on the summit of the Wind River mountains, at an elevation of 10,250 feet. The difficulties overcome in the construction of these works have been enormous. The first six miles of the ditch leading from Christiana lake and Gustave lake reservoirs passes along the side of the mountain range through a dense pine forest, in many parts of which the ditch had to be blasted through solid granite, or immense masses of granite boulders. There are in all thirty-one flumes having an aggregate length of two miles; one being seventy-five feet high. Altogether it is a worthy companion of the structures which make hydraulic mining in California and Nevada so noted.

At present this portion of the territory is outside the limits of the organized water districts and there is difficulty in recording or enforcing claims to water. The prospect for an early enlargement of mining operations and the growing importance of agriculture in certain parts of this section makes it desirable that either the legislature or Your Excellency should take early action in declaring it a water district.

GAUGING RECORD OF LARAMIE RIVER.

In December, 1888, I made a gauging of Laramie river and arranged for the securing of a weekly report of the depth of the water on the gauge rod during the winter and afterwards of two daily readings of the rod during the irrigating season. The expense of establishing the station and putting the rod in place was borne by the United States Geological Survey, but all subsequent expense has been met from the assistant's fund of this office. This record shows that during the winter months the discharge of the stream was practically uniform, being about 112 cubic feet per second from January 1st to April 1st. The maximum discharge occurred in June and was 1620 cubic feet per second. The least discharge was in September being 43 cubic feet per second. Although there was less water in the river than ever before known, some ran to waste during the period of minimum discharge, showing that in seasons of abundant supply when the maximum discharge exceeds 6000 cubic feet per second, there is an immense volume of unappropriated and unused water.

The irrigating season on the Laramie Plains may be taken as continuing from about May 1st to September 1st or 15th, or about four months. During the remaining eight months the greater part of the water runs to waste. This water should be utilized, and the numerous sites for storage basins situated at different points along and below the foot hills will in time be used for this purpose. In a region possessing the agricultural possibilities of this, the utilization of all the available water is only a question of time.

NOTE.—There is now in this office a complete record of the daily discharg of the Laramie river for 1889, and records of the discharges during the irrigatio season of several streams of lesser importance. The tabular data has been re served, however, for a subsequent report, when there can be some opportunity fo comparisons.

DUTY OF WATER.

The fixing of an approximately correct standard for the uty of water is the most important physical problem to be set- ed, before our irrigation system can be considered on a sound orking basis. At present the solution seems somewhat remote; ere is not only an almost total absence of knowledge as to the uantity used, but a further confusion of ideas as to the meaning f the term itself. It may be well, therefore, to make a few ex- lanations as to the meaning and use of the term before entering pon a discussion of its value.

By the "duty of water" in irrigation is meant the area of nd upon which a definite volume of water will successfully pro- uce crops. It is usually designated in one of three ways, viz:

1. The discharge per second or minute of a continuous ow during the irrigating season.
2. The total volume used during the season.
3. The depth to which the quantity used would cover the rface on which applied.

The first is most generally employed and the duty is ex- ressed by stating the number of acres which a miner's inch or a bic foot per second of continuous discharge will irrigate. This a convenient form of statement because it agrees with that sed in the allotment of water to ditches and the distribution erefrom. Taken without some additional limitation, however, is an indefinite term, since the length of the time of flow is not ated. To make it specific there must be some definition of the uration of the irrigating season. That is, it makes a wide dif- rence in the total volume of water whether the period of irri- ation is regarded as beginning in April or June and whether it two months or four, and what is needed is the fixing of an arbitrary standard for the length of the period in which water to be furnished and which shall be the basis of all statements to the duty of a continuous flow.

The principal difficulty, however, is the lack of knowled as to the quantity used. This cannot long continue, as the nece sity for reliable data becomes each year more imperative. Und our present laws it should be at the command of our courts, sin the actual requirements of the land should be the basis of allotments of water in the water right decrees. An approxima estimate is indispensable to both the territorial engineer and t water commissioner in performing their duties. Nor is the co mercial importance to water buyers or water sellers of le moment. It is not only a matter of dollars and cents to kno whether an inch will irrigate an acre or a cubic foot per seco eighty acres, but it is impossible in the absence of some relia approximate information to place its distribution on a busine basis. The value of water depends entirely upon what can done with it. If a cubic foot per second will irrigate one hu dred acres it is worth more to the territory and to the user th if it is only sufficient for half that area. Up to the present, ho ever, about the only criterion has been the uncertain and un liable one of personal judgment. But few tests have been ma and their results are not generally known. Yet millions of d lars have been invested in ditches and in the purchase of wa rights and allotments of hundreds of cubic feet of water ha been made by our courts.

In this connection the statement of Chief Justice Magin in the opinion accompanying the decree adjudicating priori on Crow creek, is so pertinent as to warrant its insertion.

"At the very outset I was met by a conundrum which it at this time impossible to answer, and that is, what amount water it requires to irrigate one acre of land; irrigation being its infancy in this territory, there has been no such amount of e perience by any one person or number of persons as would ju tify them in setting up even an approximate standard, and t soil being different in its character from that of Colorado, proper comparison could be made between the two distric This being the case the only standard which the court co

dopt was the standard of the number of acres of ground which
ne man is entitled to irrigate.

“Another very vexatious question which has not been sat-
factorily placed before the court is as to whether the amount of
ater claimed or allowed should flow continuously or intermit-
ntly, a few days at a time. These are questions that will prob-
bly fall within the jurisdiction and powers of the hydraulic en-
ineer, and for a solution of them he must be looked to.”

It is easy to understand the reason for the present situation.
he development of irrigation has been left almost wholly to in-
ividual enterprise and effort. Our appliances for measuring
ater from canals are as a rule imperfect in design and crude in
onstruction. To accurately measure the water used on a par-
cular stream requires a greater expenditure of time and money
an the average individual can command. It is a work that,
oth from its difficulty and character, should be undertaken by
e state, not only because of the importance of the subject to its
ficials but because in this way the results receive most publicity
d become soonest available to the people.

INVESTIGATION BY THE DEPARTMENT.

Owing to the multitude of other duties, no experiments on
is subject were begun in 1888, but during the winter I designed
d had constructed an automatic register for keeping a contin-
ous record of the water flowing in a ditch. This was placed
the spring of the present year on one of the lateral ditches of
e Wyoming Development Company, situated about 90 miles
orth of Cheyenne, in such a position as to keep a record of the
ater passing over a weir twenty inches in width. The water
this lateral was used in the irrigation of 123.7 acres of land
eded to oats. The irrigation proceeded exactly as though no
cord was being kept; there was an abundance of water and in
e time of its application and the amount used the sole idea was
produce the best results. The care of the register was in the
nds of the manager of the farm and was personally inspected
y me several times during the time in use. There is no ques-
on, therefor as to the accuracy of its measurements. The soil

is a black sandy loam with a porous sub-soil and as it had on been cultivated the two years previous it probably absorb more water than will be required hereafter, and it is an esta lished fact that wild land requires more water than land cul vated several years. Tests made on the same land hereaft may, therefore, be expected to show a higher duty. The regul slope of the surface admirably adapted it to the distribution water by flooding, this being the method employed, and as t watering was attended to by an experienced irrigator the on waste was through percolation.

RAINFALL RECORD.

A record of the rainfall of the entire season was also ke the United States Signal Service loaning a gauge for that pu pose. In this way all the water spread on the surface w measured.

At the same place a record was also kept of the water us on seven acres of potatoes. These were irrigated through different lateral, the weir over which the water was measur being twenty-four inches in width. Owing to the greater slo of the surface of this plot it was impossible to avoid some wast the exact amount of which is not known. The oats received tw waterings, their irrigation beginning June 22nd and ending A gust 16th. From the time of beginning to its completion the was only a break of nineteen hours in the discharge. Th greatest quantity used at any one time was 5.85 cubic feet p second. The potatoes received only one watering, on July 24 and 26th.

The cuts and tables which follow include an illustration the instrument used to measure the water, a graphical presen tion of the total depth of water spread over the ground surfa the total amount of water used, average discharge and equival duty.

OATS.

	April.	May.	June.	July.	Aug.	Irrigating Season.
Depth of Rainfall	0.50	3.45	3.37	1.99	0.75	10.06
Depth of Irrigation...			7.236	21.936	2.124	31.296
Total...........	0.50	3.45	10.606	23.926	2.874	41.356

SUMMARY.

Total number of cubic feet of water used, 14,056,235.55.

Time employed, 54.5 days.

Area of surface, 123.7 acres.

Average discharge for period used, 3.79 cu. ft. per sec.

Equivalent average discharge for irrigating season of four months (May, June, July, August) 1.32 cu. ft. per sec.

Or an equivalent duty of one cubic foot per second for continuous discharge of 93.8 acres.

POTATOES.

	April.	May.	June.	July.	Aug.	Irrigating Season.
Depth of Rainfall....	0.50	3.45	3.37	1.99	0.75	10.06
Depth of Irrigation...				12.744		12.744
Total...........	0.50	3.45	3.37	14.734	0.75	22.804

SUMMARY.

Total number of cubic feet of water used, 323,825.

Time employed, 36 hours.

Area of surface, 7 acres.

Average discharge for period used, 2.5 cu. ft. per sec.

Equivalent average discharge for irrigating season of four months (May, June, July, August) 0.0305 cu. ft. per sec.

Or an equivalent duty of one cubic foot per second for a continuous flow of 229.5 acres.

From the foregoing summary it will be seen that the water used in irrigating the oats would have covered the entire surface to a depth of 2.6 feet or 1,132,560 cubic feet on each acre. A uniform flow of one cubic foot per second for an irrigating season of four months (123 days) would discharge 10,627,200 cubic feet which, divided by the quantity used on one acre, gives 93.8 for the number of acres which a continuous flow of one cubic foot per second would water. Fixing the length of the irrigating season at four months is of course simply arbitrary but, as before explained, in all calculations of the duty of water as a continuous flow the fixing of a definite length of time for the irrigating season is a necessary condition. That taken is believed to be a fair average for the region where the experiments were conducted.

It may be considered also that the measurements made represent a higher duty than would have been obtained for the use of a continuous flow throughout the season. This would probably be true if we considered simply one crop, but in actual mixed farming, in watering a diversity of crops, the farmer uses all the water at his command on one crop after another in succession throughout the season, so that the calculation here employed cannot be considered misleading. In these tests the water was used on meadow land prior to being turned on the oats.

The watering of the potatoes only occupied thirty-six hours, in which time the water used was equal to a layer over the entire surface 1.062 feet in depth and considered as a uniform flow for the entire season of four months would make an equivalent duty for one cubic foot per second of 229.5 acres.

From this record it will be seen that there is a wide difference between the requirements of different crops. As a rule small grain requires fully twice as much water as either corn or potatoes. The latter are cultivated in rows and watered in furrows, which facilitates the speedy passage of water. Corn requires the least water of any important crop. The order of arrangement based on the quantity of water used is about as follows: native hay, tame grasses, small grain, root crops (including potatoes), corn.

The depth of the water spread over the surface in July (nearly two feet) seems unnecessarily large and to those unacquainted with the enormous evaporation which takes place during the summer months, it would seem that such a volume of water would be ruinous, the results, however, sustain the judgment of the irrigator. Part of the field was damaged by hail, yet the average yield was forty bushels per acre and one measured acre in the unharmed portion gave a yield of seventy-five bushels.

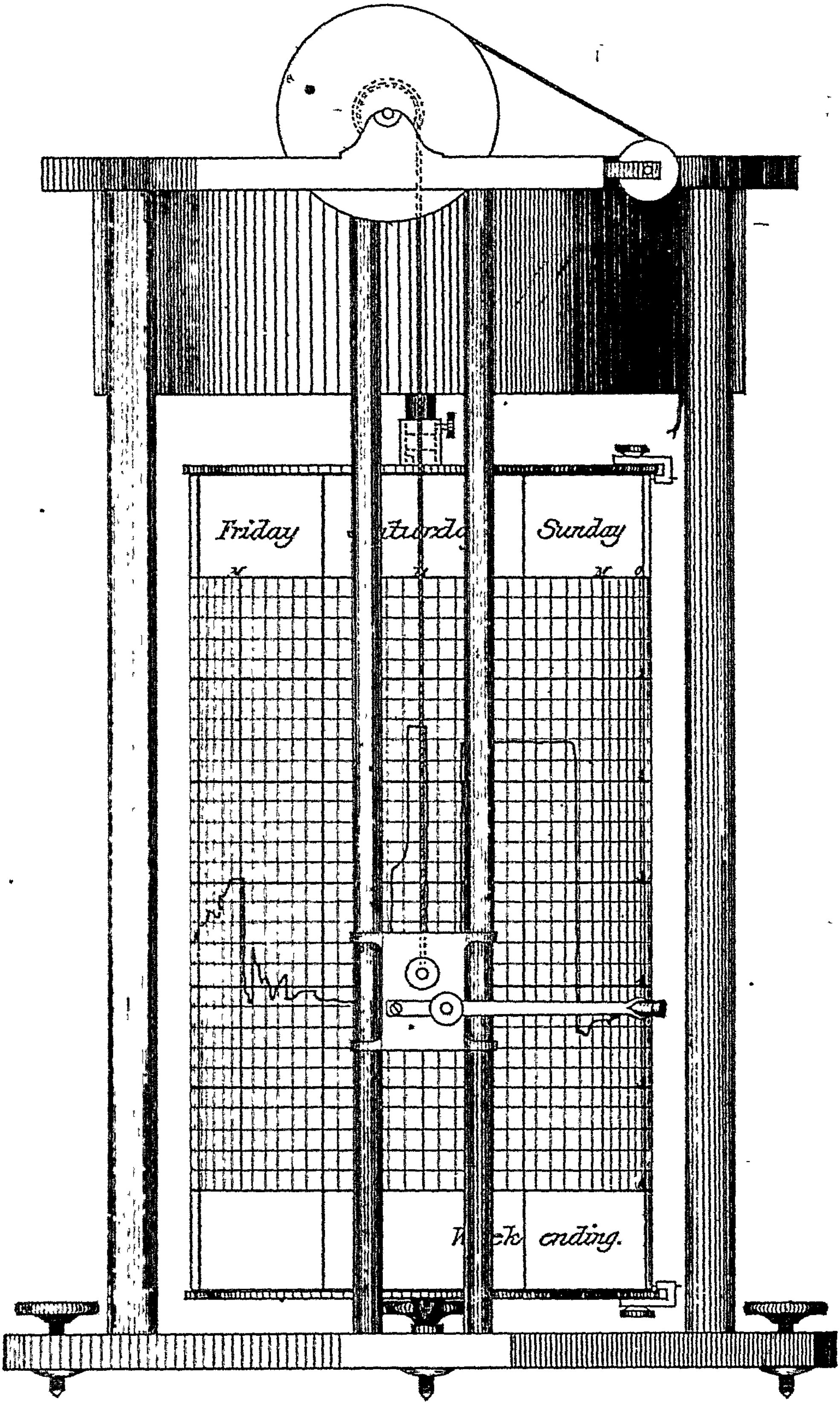
The potatoes captured the first premium at the territorial fair and gave an average yield of 150 bushels per acre.

It must be borne in mimd that the above water measurements were made at the place it was used and no allowance was made for the loss by seepage and evaporation in its passage through the main canal. This loss should be considered in making allotments of water and some tests which can be made a basis in determining its amount should be instituted at once. What we will need for many years is definite information on the practical problems connected with water distribution and this office can do the agriculture of the territory no greater service than by taking up and investigating these questions through a series of years.

The above tests are intended to show what has been used under ordinary conditions, and no precaution which suggested itself has been neglected in insuring their accuracy and completeness. They need, however, to be extended to other localities and to include other crops before being made the basis of a general estimate. From the results of a large number of canal gaugings in Colorado and in this territory I am convinced that the results obtained are not far from the average requirements of such crops through this region. In a test made in Colorado in 1887 the duty of a cubic foot per second was 83.4 acres. The report of the state engineer of Colorado for 1888 and the calculations made by the present state engineer all go to establish the fact that the actual duty of water is much higher than was formerly supposed. Competent observers in Colorado fix the average duty at between 80 and 100 acres for one cubic foot per second.

In this connection it may be a matter of some interest to insert here a table which is believed to be reliable, giving the duty obtained in other irrigating countries, that for Colorado being based on recent testimony, and all except Colorado and Wyoming being taken from a table published in the transactions of the Am. Soc. C. E. for 1887. It will be seen that the results obtained in the tests will compare favorably with those of some of the older irrigation states although below the greater portion.

LOCALITY.	CROP.	AVERAGE RAINFALL.		DUTY
		In irrigating or crop growing months, March to September.	Per Annum.	
		INCHES.	INCHES.	AREAS.
Juinna Canal, India...	Wheat, Maize, etc.......		38 to 44	306
Ganges Canal, India..	Wheat, Maize, etc.......		38 to 56	232
Upper India.........	Wheat, Maize, etc.......			267
Northern India......	Cereals................		38	200
Genil Canal, Spain....	Cereals and Vines.......	6	22	240
Valencia Canal, Spain	Cereals................	5	16	200
Valencia Canal, Spain	Corn, Grasses, etc.......	5	16	324
Valencia Canal, Spain	Garden and Orchards....	5	16	162
Northern Peru.......	Corn and Cotton.........			160
Northern Chili.......	Corn and Grain.......:.		—	190
Lombardy, Italy.....	All crops, including rice.	22	38	90
Piedmont, Italy......	All crops, including rice..	28	38	60
Average all Italy.....	All crops, including rice..	25	38	67
UNITED STATES.				
Colorado	All Crops..............	12	15	80-10
Wyoming...........	All Crops..............	10	14	100



WYOMING NILOMETER.

Designed by Elwood Mead, Territorial Engineer.

FRANK BOND, DEL.

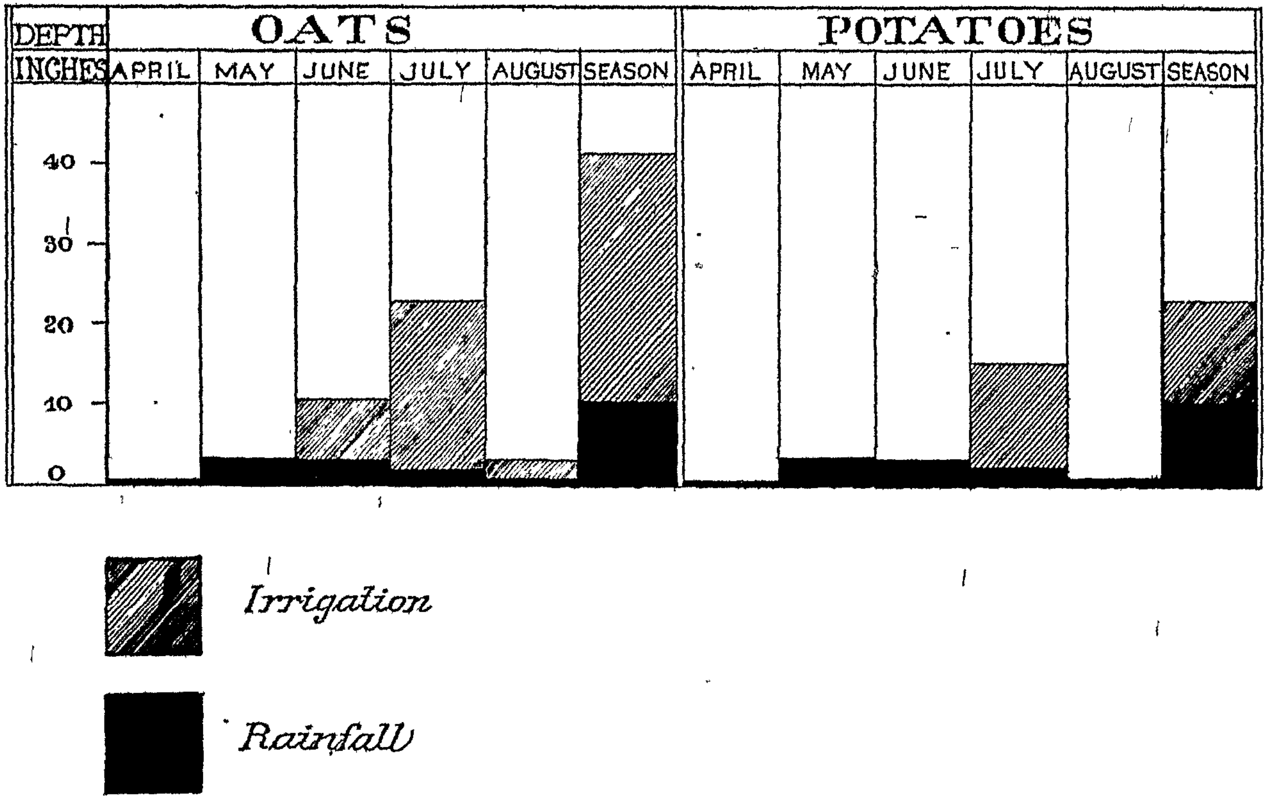


Diagram Showing Depth of Water on Land from Rainfall and Irrigation During Irrigating Season.

SUPERVISION OF THE PUBLIC WATERS.

BOUNDARIES OF WATER DISTRICTS. REPORTS OF WATER COMMISSIONERS.

WATER DISTRICTS.

By an act of the legislature of 1886 eight water districts, he boundaries of which are described hereafter, were organized. Provision was made at the same time for the creation of additional districts by proclamation of the governor. One district, No. 9 has been so established. These nine districts include early the whole territory, the unorganized portions being the orthern part of Uinta county and a strip between districts three and four.

WATER COMMISSIONERS.

The supervision of the public water within each of these districts is vested in a water commissioner who is appointed by the governor at the recommendation of the county commissioners. The following table shows the persons who have filled and those who now hold the positions:

WATER COMMISSIONERS.

No. of District.	Name of Commissioner.	Postoffice Address.	Date of Appointment.	Date of Resignation.
1	D. McUlvan......	Cheyenne...	May 13, 1887..	Did not qualify.
1	Jno. Nolan........	Cheyenne...	May 2, 1888....	March, 1889.
1	W. D. Pease......	Cheyenne...	April 12, 1889..	
2	Chas. Bellamy....	Laramie City	June 14, 1887..	
3	William S. Kerr...		March 31, 1886.	Term expired.
3	Frank O. Williams	Saratoga....	June 14, 1889...	
5	C. F. Hersey......		March 31, 1886.	
5	Geo. Ohlman......	Ohlman.....	Oct. 11, 1886..	Term expired.
5	J. E. Shannon.....	Buffalo......	Oct. 14, 1889...	
6	Albert Weaver....	Sundance ...	July 15, 1889...	
7	W. H. Moss.......	Piedmont...	June 3, 1886....	
8	Samuel Iiams.....	Lander	Oct. 7, 1886....	
9	John Wilkes......	Afton	July 26, 1889...	

REPORTS OF THE COMMISSIONERS.

In calling for reports from the various water commissione I asked that they give information on the following topics:

1. Number of days employed in each month since Janua 1st, 1889.
2. State the streams on which you divided water and e plain whether you were called out to divide water for irrigati or domestic use.
3. If any difficulties were encountered in this work sta what they were.
4. Will one water commissioner be able to supervise th division of water on all the streams in your district or will th present district need dividing.
5. Have the adjudications of priorities in your distri proven satisfactory. If not, state the reason.
6. Is agriculture extending in your district.
7. Any additional facts you may wish to present.

DISTRICT NO. 1.

Report of Commissioner Walter D. Pease.

Dear Sir: In compliance with your circular of Sept. 25th 1889, requesting a report of my official doings as water commis sioner for District No. 1, for the season of 1889, I hereby subm the following and also answers to the several questions there propounded.

I was appointed water commissioner for District No. 1 o the 12th day of April, 1889, because of the resignation of Joh Nolan, so that my report will not include all of the irrigatin season of 1889.

Mr. Nolan's resignation was offered, and accepted som weeks before my appointment by Governor Warren and as th city of Cheyenne was very anxious to secure its full rights to wate under the law so as to fill the reservoirs, to provide for a seaso of drouth and the better to spare the water when most neede by the farmers on Crow creek, above the city, I was appointe "special commissioner" by you on the 27th day of March, 1889

In compliance with the instructions then received I starte to examine the ditches taking water out of Crow creek and th

nount taken. I spent nine days on that examination and found
venty-four ditches that were taking water from the creek. I
xperienced great difficulty in regulating and measuring the
nount of water allotted to any ditch, except in a rough way, be-
use there were, with two exceptions, no head gates. The
arest estimate I could make gave only about eight cubic feet
water per second at any one place in the creek, and yet the
venty-four ditches were taking from one to five cubic feet each,
the points where they were located. The time occupied as
ecial commissioner was three days in March and six days in
pril, for which time the city of Cheyenne paid.

On the 13th of April, having received my appointment as
ater commissioner for district number one and a request signed
the officers of the city of Cheyenne, as owners of the City ditch,
e City of Cheyenne Water Pipe Line, and the Reed ditch, and
so by the president of the Organ Ditch company, that they
ght be protected in their rights under the decision of the court,
tarted to execute said decree. On that trip I was much pleased
have your assistance and counsel for three days, and that you
ght know some of the difficulties encountered and the prejudice
be met with. In those three days we found thirty ditches
king water, and each one taking nearly all the water it could
t at the point where such ditch tapped the creek. But in none
these ditches are there the proper appliances for measuring
water or controling the amount. Afterward we found seven
re ditches taking water and some of these with no water-
ht. Some of the ditch owners seemed to think they were not
npelled to regard a verbal notice to close a ditch, therefore
county commissioners gave permission to have notices printed
I had it done on cloth, as follows:

NOTICE!

In accordance with the provisions of sections 1334 and 1338,
vised Statutes of Wyoming, this ditch has been closed by the
ter commissioner. It must not be opened or interfered with
il permission is received from me. (See section 1335 of the
vised Statutes.)

(Signed) WATER COMMISSIONER,
ted 1889. District No. 1, Wyo. Ter.

I posted eighty-six of these notices with better effect.

On Crow creek alone I found twenty-seven ditches th have no water rights. Most of these are on the headwaters a smaller branches of the creek, and the owners say that it cost much to get the water right and meet the expenses of adjudi tion that it will not pay, so they take what they can get.

In determining the priorities of the various ditches th seems to have been no particular rule followed as to the amou of water each ditch should be entitled to. There is one di which claims water to irrigate fifty acres and is allotted ni cubic feet per second, and another which claims water for 2 acres is only allotted four cubic feet per second, thereby jus creating much dissatisfaction.

The method of locating the headgates of the various ditch seems to have been mere guess work and often very wide of t mark. Sometimes a ditch is so located by the record as to pl it several miles away from the real location.

In answer to your direct questions I would say:

1. I was employed in April, 13 days; May, 9.5 days; Ju 6 days; July, 3 days; August, 12 days; September, 5 days. To 48.5 days.

2. I was called upon to divide the waters of Crow cre Horse creek, Chugwater and Cottonwood creeks. As decr have been rendered to effect only Crow, Horse and Bear cree I only worked on Crow and Horse creeks.

On Crow creek the water was divided for domestic use well as irrigation.

3. The streams in this district, with their branches, each from 80 to 125 miles long, averaging about 100 miles ea and there are fifteen streams, requiring a journey of 1,500 m to visit the district once a year. The time allowed the comm sioner, fifty days, is inadequate, and I would suggest that district be divided or that the time for which the commissio and his assistants are employed be under control of the territo engineer.

4. The appropriations of water are not satisfactory, si the amounts are not in proportion to the land to be irriga

Then land that is to be watered for hay alone does not require as much water per acre as if a cultivated crop was to be raised, and this has not been taken into account in the adjudication. Some ranchmen use so much water on their grass lands that it runs out the better sorts of grasses and brings in the fox-tail or swamp grass. Should not the authority be vested in somebody to say when any land had water enough?

5. Not having visited the northern portions of the district, I cannot say whether agriculture is on the increase there or not, but in the portions visited it most surely is. New land is being broken every year and if more water could be had it would all be taken up very quickly for agricultural purposes.

6. It seems to me that our laws ought to be so amended that any person failing to provide proper head gates, waste gates, and measuring flumes, should not be entitled to the use of water under the decree until such defects were remedied. Also that any person building a dam across any stream either to raise water to the level of their ditch, or for any other purpose, should provide a waste gate in such dam that will drain the water down to within one foot of the bottom of the stream. In some places water is held back by dams where no ditch is taken out. Then when any person wishes to construct a ditch, he should first get permission from the territorial engineer, or a deputy, both for the right to water and the size of the ditch, which should be conditioned on the amount of water in the stream yet unappropriated, and the amount of land to be irrigated or reclaimed.

Section 15 of chapter 77, laws of 1888, provides for the protection of fish in all the streams of the territory. Would it not be a wise thing to make it the duty of somebody to report to the fish commissioner the failure to comply with this section? I know of cases where thuosands of young fish, and some large ones, too, were run out on the land last season and left to die. Are not the two branches of our territorial laws working directly against each other in this? I have also found that some ditch owners leave their ditches carrying the water out of the creek long after they have ceased to use it on their crops. Should not provision be made whereby owners should close their ditches when water is no longer needed for that season's crop? and that a printed or written notice, posted at the head of a ditch, as to the closing or time of opening or closing a ditch, shall be binding on the owners or persons taking water therefrom.

Another defect in our law as it now stands is that streams are so divided that part is in one district and part on another. The result is that the rights of parties living in the lower district are imperfectly protected.

All of which is most respectfully submitted.

WALTER D. PEASE,
Water Commissioner, District No. 1.

DISTRICT NO. 2.

Report of Commissioner Charles Bellamy.

DEAR SIR: I have the honor to submit to you my report as commissioner of Water District No. 2, Albany county, Wyoming Territory.

I have been employed but three days in actual discharge of duty since my appointment to the office in June, 1887. The three days employed were in the month of August, 1889. I was called upon at that time by Howard Ingham, et. al. to divide the waters of the Little Laramie for domestic purposes. I found the stream or natural channel obstructed in several places by dams and embankments without waste weirs, gates, or any device by which the waters could be turned into the natural channel. I met with opposition and had no success in obtaining the water desired by the applicants for domestic uses.

Water District No. 2, is, in my opinion, too large and takes in too many streams for one commissioner to look after or to supervise with any degree of care or to the efficient working of any beneficial results. The Laramie river and its tributaries would, it appears to me, make a district sufficiently large for one commissioner to take the proper control so that good results might follow, and I think it advisable to carefully consider the changing of the boundaries of this district. The law allows the appointment of assistants in cases of necessity, but I cannot see how, even with assistants, a water commissioner could do effective work if he has such an extent of country, such a large number of streams of so great length, and so short a time to work as this district. It would keep him traveling all the time.

The adjudication of priorities in this district has not been brought before the court, the only reasons I can give being the procrastination of the ditch owners and their ignorance of the law. Most of them think that if they have their ditches recorded it is all that is required. I have received during the past two years several complaints and requests for a division of the water, but when I have explained to them the requirements of the law it seems to have ended, as they want someone else to commence action.

I am inclined to the belief that the adjudication of priorities should be acted upon immediately as the delay only increases he difficulties, and ditch owners and water commissioners have no power to divide the waters of a stream under the present condition.

I would state that the powers of the water commissioners should be enlarged as their duties and experience gives them a greater knowledge of the requirements and needs appertaining o irrigation. As for example, if section 1335 of the Revised Statutes of Wyoming be in force should they not have power to emove dams, embankments or obstructions constructed across he natural channel of a running stream? Otherwise, how can be possible to obtain water for domestic use for settlers living elow said obstruction. As I take it domestic use takes prece-ence over irrigation and does not require adjudications of prior-ies by the court.

Agriculture is meeting with fair success wherever tried, but ay seems to be the principal crop. About 15,000 tons of hay ere cut in the Little Laramie valley the past season.

I have not made any actual surveys as to the location of orage reservoirs. At the base of the Snowy Range, in town-hip 15 north range 80 west, there are a large number of lakes at I believe could be made available for the storage of immense uantities of water that could be brought down the Little Lara-ie in times of scarcity. The heads of Sand, Fox, Rock, Lake d Libby creeks, also the middle fork of the Little Laramie, all ntain good reservoir sites, but as to capacity or cost of con-ruction I have made no estimates.

I believe the plan a very good one of running ditches fro these mountain streams out on the benches and table lands in th mountains and permitting it to freeze and form artificial glacier that will melt more slowly than the snow and tend to keep u the flow in the streams. I also believe that the flow of the mountain streams could be increased in the summer season by trenche branching out toward the foothills, thus tapping the under surface flow and bringing it to the surface in the natural channel

Respectfully submitted,
CHARLES BELLAMY,
Water Commissioner, District No. 2.

DISTRICT NO. 3.

Report of Commissioner Frank O. Williams.

1. I was employed in work as water commissioner nin days in the month of July. Other applications were made, b as their claims had not been adjudicated by the courts I cou not act.

2. I divided water on Savory, Jack and Pass creeks. W called to divide water for both irrigation and domestic purpose

3. The claims had not been properly adjudicated. In th attempt to divide water for domestic purposes, it can only done to the injury of all ranches above on the stream. There not a sufficient flow of water at the lower end of any of the creeks in the irrigating season. By making domestic purposes preferred priority, as now by law, it works injury to nearly and benefit to but very few.

4. It will need dividing under the present system.

5. None at present have been adjudicated but it is evide that when it is applied it will lead to trouble and costly litigatio

6. Yes. If the water could be properly distributed a the rights of individuals could be so defined that they could kno what their rights were, the next season would see a large i crease in the area culitvated.

Respectfully,
FRANK O. WILLIAMS,
Water Commissioner, District No. 3.

DISTRICT NO. 7.

Report of Commissioner W. H. Moss.

In answer to yours of the 26th I would say that there has
en for two years a scarcity of water and while perhaps there
ve been neighborhood grievances, in only one instance since
appointment has the water commissioner been called upon to
tle or divide the water, and not at all in 1889. In fact in
ny instances there was no water to divide.

The question of the priority of rights should secure the care-
attention of our law makers and be so defined as to leave no
ubt as to what amount of water and for what purpose the
imant should use it. With this question settled I think there
uld be but little for the commissioner to do, and at the present
e of development of this portion of the territory one commis-
ner would be enough for this district.

The country is gradually improving and each year sees
re land under cultivation and particularly as regards agricul-
products which seem to be universal throughout this district.

Respectfully yours,
W. H. MOSS,
Water Commissioner, District No. 7.

DISTRICT NO. 8.

Report of Commissioner Samuel Iiams.

The water commissioner of District No. 8, reports that he
nt ten days in July and twelve in August dividing water on
ldwin creek, one day on Willow creek and two on Twin creek,
that the scarcity of water added greatly to the difficulty of
work. He reports that the rights to water on Baldwin creek
ve been adjudicated but that it is not entirely satisfactory, since
appropriations are not based on the area of the land irrigated,
on the carrying capacity of the ditches and the reported
acity of each of these ditches exceeds the discharge of the
eams. There is further complication in the fact that thirteen
ches taking water from the stream are not included in the
ree. Mr. Iiams also reports that a large extension could be
de to the irrigated area if reservoirs were built to store up

the waste water. He says that there are fine sites for such r ervoirs on Baldwin, Willow, and Twin creeks.

The lack of headgates on the ditches proves a serious d culty in making a legal division of the water, as in their abse it is almost impossible for the water commissioner to regulate supply which each ditch receives.

Another difficulty is the separate diversion by each indiv ual of the water he uses.

(Signed) SAMUEL IIAMS,
Water Commissioner, District No. 8.

DISTRICT NO. 9.

Report of Commissioner John Wilkes.

Mr. Wilkes reports that he spent three days in August a one in September dividing the water for irrigation; that the p cipal difficulty arose from the lack of head gates in the ditch No priorities have been adjudicated in his district, consequen he could only act by general consent of the parties interest He reports great progress in agriculture, about ten times much grain having been grown in 1889 as there was in 18 and the prospect is that fully double the area of the present y will be sown next season.

METEOROLOGY.

The peculiar climatic conditions of this region lends added erest to meteorological records and warrants paying some at- tion to the.subject in this report. Of these the rainfall records ssess the greatest interest from their relation to the subject of ter supply for irrigation and from the light they throw on the estion of increased rainfall.

In the following table is contained a summary of all the reli- e rainfall records for this territory in possession of the signal vice. It includes reports dating back to 1850 and embraces dely separated districts. Its examination shows that the eastern tion of the territory has the greatest rainfall, the annual erage precipitation for the eastern stations being several inches eater than for the western ones. They also fail to afford any couragement to the belief that rainfall is on the increase as the hest record for any year was for 1852. The oldest station is rt Laramie, which has just been abandoned. Its loss is eatly to be regretted, as the duration of these records make them great value for the purpose of comparison. The averages for different months at the different stations on the plains show a striking manner the small precipitation which takes place ring the winter and aids in explaining to those not familiar th this country, how it is that cattle can subsist on the open nges without any other food supply than the native grasses. the stations referred to the average precipitation for each of winter months is considerably less than one inch. In conse- ence of this grass is not hidden or damaged by snow, but is cessible and nutritious throughout the year; nor are animals bjected to the chilling effects of the rain and snow storms of humid regions. There is cold weather, but the dryness of the nosphere permits its effects being more easily withstood.

On the mountains, opposite conditions prevail; there the aviest precipitation occcurs during the winter months.

TEMPERATURE AND SUNSHINE.

Second in point of general interest are the records of su shine and temperature. These phenomena exhibit some peculia and important features not included in the regular Signal Servic observations, which is greatly to be regretted. For example, is a matter of common experience that the hours of sunshine a much greater here than in the less elevated and more humi parts of the country, but no record has been kept within the te ritory showing the percentage of actual sunshine as compared t the total hours of possible sunshine. This is an important cl matic advantage contributing to healthfulness and adding an a preciated charm and enjoyment to life.

Another marked feature of the climate of this region, no shown in ordinary temperature records, is the marked differen between the temperature in the sun and in the shade. This due to the clearness and dryness of the atmosphere and to th fact that the sun's rays, for the average elevation of this territor have to pass through one-fifth less air to reach the earth than necessary at sea level. They retain to a greater degree the original intensity, while the atmosphere is less heated than lower elevations. If, therefore, a thermometer is placed in th sun so as to absorb all the energy of the sun's rays, it shows much higher temperature and a far wider difference between su and shade than is manifest at the lower altitudes and in a mois climate. Three illustrations of this are given, showing the i creased difference for increased elevations.

STATION.	Elevation above Sea Level.	Temperature in Sun.	Temperature in Shade.	DIFFEREN
Washington, D. C.	80 feet.	75	52	23
Fort Collins, Colo.	5,200 feet.	167	87	80
Mt. Whitney, Cala.	12,000 feet.	236	58.7	113.3

The same causes which facilitate radiation from the sun t the earth also makes terrestrial radiation very active. There a consequent rapid cooling of the atmosphere at night, makin the sleeping hours pleasant even in the warmest period of summe

It becomes an important question in connection with the

Table showing the average, the greatest, and the least known rainfalls for each month

STATION.		Number.	JANUARY.					FEBRUARY.					MARCH.					APRIL.						
				Maximum		Minimum			Maximum		Minimum			Maximum		Minimum			Maximum.		Minimum			Maxi
			Average	Amount.	Year.	Amount.	Year.	Average.	Amount.	Year.	Amount.	Year.	Average	Amount.	Year.	Amount.	Year.	Average.	Amount.	Year.	Amount.	Year.	Average.	Amount.
NATIONAL PARK RESERVATION.																								
Fort Sheridan	Lat. 44.58 Long. 109.51	635	7.70	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......		
FREMONT COUNTY.																								
Fort Washakie	Lat. 43.01 Long. 108.56	636	0.61	2.34	1874	......	1878	0.36	1 04	1881	0.10	1886	1.02	2.05	1886	0.01	1882	1.86	3 73	1883	0 52	1882	2.26	
Fort Stambaugh	Lat. 42.30 Long 109 00	637	1.10	1.53	1876	0.54	1878	0.43	0.77	1876	......	1877	1.65	2 79	1876	0 61	1877	1.45	1 85	1878	0 98	1876	2.30	
JOHNSON COUNTY																								
Fort McKinney	Lat. 44.26 Long. 106.44	638	1.05	1.10	1887	1.00	1886	0.40	......	......	......	......	0.30	......	......	......	......	1 05	......	......	......	......	0.05	
CROOK COUNTY.																								
UINTA COUNTY.																								
Fort Bridger	Lat 41.28 Long. 110.30	639	0.70	2 89	1881	......	1860 63–65	0 43	1 45	1873	......	1860 1863	0 79	4.50	1869	......	1863	0.74	1.58	1882	......	1863	1.11	
CARBON COUNTY.																								
Fort Fred Steele	Lat. 41.43 Long. 106.55	640	0.84	3.50	1870	0.07	1874	0.65	2.50	1870	0 05	1877	0.92	2.60	1875	......	1882	1.89	6 00	1870	0 25	1877	1.12	
Edson	Lat. 41.42 Long. 106.41	641	0.51	0.76	1880	0.07	1878	0 40	1.06	1878	T	1879	0.69	1.07	1878	0.07	1879	2.20	2.73	1879	1.83	1878	1.35	
ALBANY COUNTY.																								
Fort Fetterman	Lat. 42.50 Long. 105.28	642	0.39	0.54	1873 1877	0.13	1878 1880	0 73	3.40	1873	0.12	1877	1.34	3 42	1877	0.11	1875	1.58	3 72	1878	......	1876	2.51	
LARAMIE COUNTY.																								
Fort Laramie	Lat. 42.14 Long. 104.29	643	0.72	4.24	1886	......	1858 1860 1865	0.87	4.28	1886	......	1859 1865	0.70	1.78	1853	......	1857 1859 1860	1.32	4 75	1873	0.06	1863 1876	2.55	
Fort Sanders	Lat. 41.16 Long. 105 32	644	0.88	3.53	1875	0.06	1870	0.61	1.26	1878	......	1877	0.64	1.11	1876	0.13	1871	1.13	3 63	1870	0.10	1878	1.47	
Cheyenne	Lat. 41.08 Long. 104.48	645	0.28	0.88	1883	0 02	1872	0.29	0 93	1870	0 02	1873	0.63	1.59	1884	0.06	1882	1.38	3.76	1885	0.17	1880	[illegible]	
Hat Creek	Lat. 42.5 Long. 104.20	646	0.02	0.04	1878	0.03	1879	0.04	0.05	1880	0 02	1878	0.07	0.18	1878	......	1879	3.48	3.93	1879	0 04	1878	2.62	
SWEETWATER COUNTY.																								

for each month and for the year in Wyoming Territory.

PRIL.			MAY.					JUNE.					JULY.					AUGUST.					SEPTEMBER.					OCTOBER.					NOVEMBER.					DECEMBER.							
um	Minimum			Maximum		Minimum			Maximum		Minimum			Maximum		Minimum			Maximum		Minimum			Maximum		Minimum			Maximum		Minimum			Maximum		Minimum			Maximum		Minimum				
Year.	Amount.	Year.	Average.	Amount.	Year.	Amount.	Year.	Average.	Amount.	Year.	Amount.	Year.	Average.	Amount.	Year.	Amount.	Year.	Average.	Amount.	Year.	Amount.	Year.	Average.	Amount.	Year.	Amount.	Year.	Average.	Amount.	Year.	Amount.	Year.	Average.	Amount	Year.	Amount.	Year.	Average.	Amount.	Year.	Amount.	Year.	Annual.	Maximum.	Minimum.
...	...	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4.38	...	...	...	...	...	...	...
83	0.52	1882	2.26	5.01	1887	....	1875	0.61	2.46	1886	......	1875 1876	0.69	2.50	1875	0.05	1877	0.37	1.15	1875	......	1876 1877 1886	0.51	1.24	1877	......	1876	1.01	2.18	1874	......	1875 1876	0.61	2.29	1886	0.07	1882	0.23	0.60	1874	......	1875	10.14	14.74—1886	3.34—187
78	0.98	1876	2.30	3.65	1877	0.59	1875	0.17	0.32	1875	0.05	1877	0.58	1.15	1875	0.16	1877	0.38	0.67	1876	0.08	1874	0.66	1.00	1874	0.51	1876	0.78	1.49	1874	......	1875	0.81	1.13	1875	0.54	1876	0.49	1.02	1877	0.21	1874	10.80	12.34—1876	9.98—187
..	....	......	0.05	......	......	....	......	1.55	......	....	......	......	1.70	...	...	...	....	0.40	......	......	......	......	0.70	......	......	......	......	1.80	......	......	......	......	0.45	......	......	......	......	0.15	......	......	......	......	9.60	......	......
82	....	1863	1.11	5.02	1863	0.06	1865	0.55	3.25	1872	....	1865 1871	0.57	1.80	1860	0.12	1886	0.90	2.57	1869	0.06	1871	0.79	5.05	1865	......	1871	0.54	1.30	1883	0.01	1867	0.68	2.80	1871	0.04	1865 1884	0.70	4.13	1859	0.12	1860	8.50	13.26—1869	5.05—1860
70	0.25	1877	1.12	2.92	1884	...	1886	0.77	3.25	1870	......	1876	0.68	2.01	1869	0.08	1877	0.94	3.35	1869	0.05	1877	0.73	1.88	1878	......	1879	1.23	2.75	1869	0.14	1885	0.56	2.82	1871	0.10	1873 1878	0.70	1.24	1871	0.22	1885	11.03	23.45—1870	6.50—1873
79	1.83	1878	1.38	2.63	1878	0.12	1879	0.84	0.93	1878	0.75	1879	0.83	1.56	1878	0.10	1879	0.40	0.62	1878	0.17	1879	1.56	2.86	1878	T	1879	1.35	1.45	1877	1.16	1878	0.22	0.45	1879	0.08	1877	0.93	1.49	1879	0.14	1877	11.31	14.15—1878	8.00—1879
78	......	1876	2.51	6.04	1873	0.44	1869	1.26	2.58	1874	0.40	1873	1.75	4.70	1881	0.77	1880	0.96	2.46	1870	0.12	1879	1.14	4.20	1881	......	1871 1872 1879	1.18	2.88	1871	......	1876	0.85	2.50	1871	0.05	1874	1.37	6.02	1872	0.05	1874	15.06	30.81—1881	9.21—1876
73	0.06	1863 1876	2.55	12.19	1853	......	1865	1.34	4.95	1853	......	1861 1872	1.49	4.15	1856	0.02	1876	1.21	2.93	1855	......	1860	0.96	3.39	1855	......	1861 1873	0.90	2.72	1849	......	1860	0.48	3.23	1886	......	1860 1862 1870	0.84	4.85	1855	......	1864 1874	13.38	31.42—1852	2.38—1860
70	0.10	1878	1.47	2.80	1878	0.15	1875	1.53	4.90	1878	0.05	1871 1875	1.82	3.07	1874	0.27	1869	1.66	4.90	1878	......	1871	0.99	1.91	1877	0.40	1871	0.88	1.70	1877	0.04	1870	0.78	2.27	1876	......	1870	0.53	1.05	1876	0.03	1869	12.92	17.77—1872	8.16—1871
5	0.17	1880	2.00	4.83	1884	0.32	1886	1.46	3.6	1883	0.07	1879	1.64	3.90	1872	0.30	1870	1.46	2.50	1878	0.07	1870	0.98	2.02	1877	......	1876 1879	0.67	1.99	1877	......	1876	0.31	1.11	1885	......	1878	0.22	0.80	1883	0.01	1881	11.32	19.24—1883	5.03—1876
9	0.04	1878	2.92	4.83	1878	1.00	1879	1.00	3.00	1880	......	1878 1879	1.20	1.50	1878	0.90	1879	1.70	3.65	1880	......	1879	1.12	2.23	1878	......	1880	2.00	2.78	1877	1.22	1878	1.46	2.23	1877	0.68	1878	0.25	0.31	1878	0.10	1877	17.26		

phenomena to know what influence the intense and long continued stimulus of the sunlight of this region has on plant growth. That it does exert an influence cannot be doubted; nor that this is an important factor in the securing of the enormous yields and increased weights of small grains.

STORAGE RESERVOIRS.

UNITED STATES IRRIGATION SURVEY. INVESTIGATION OF THE UNITED STATES SENATE COMMITTEE ON IRRIGATION.

The act providing for the survey of reservoir sites, approved October 2, 1888, was one of the most important measures as affecting this region ever enacted by congress. Since the inauguration of the work, the growth of popular interest on the subject, and the increased information of the value and importance of the reclamation of the arid lands, has led to measures being taken for a comprehensive investigation of the subject by the national government. A second appropriation has been made for continuing the survey and a special committee of the United States senate devoted several months to an investigation into the possibilities of irrigated agriculture.

PURPOSES OF THE SURVEY.

It is impossible at this time to predict what may come from these labors or to forecast what future action the national government may take. At present there seems to be no disposition to extend any aid in the construction of works, but simply to obtain for congress and the country information of what can be accomplished and the means necessary to securing the best results. Whatever conclusion may be reached, the making of a systematic examination of the irrigable lands cannot but result in the obtaining of valuable data and prove an important influence in securing the adoption of more systematic methods of utilizing the water supply. There will, of course, be a wide diversity of opinion as to the measures to be adopted for securing the best results, but in the case of this territory I cannot but believe that both land and water should be under the control of the local rather than the national government. The reasons therefor are given in a statement to the senate committee and included in this report.

LOCAL CONTROL OF LAND.

The principal objection which has been expressed to the proposition to turn the control of the lands over to the local authorities has been the fear of mismanagement, by which the lands would fall into the hands of speculators rather than actual cultivators. This would not, I am confident, be the case in this territory as its prosperity is too largely dependent upon agriculture for this to be permitted.

From my information as to the views of the people of this territory, and of the natural conditions which prevail, I believe that the following statements will prove correct:

1. That monopolies of land in the arid region need not be feared; it is the monopoly of water that is to be guarded against. The whole experience of the west goes to prove that the holding of large tracts of irrigated farming land is an unprofitable enterprise; success depends on intense culture and close attention which can only be secured by cultivation and ownership being combined. It is entirely different with water. Whoever controls it controls both the productiveness and value of the land, and the repeated examples of extortion and abuse which have resulted from placing its control in the hands of others than the owners of the land, or of the state, should be a warning not to be disregarded.

2. That the land and the water should be under one control and that a supervision should be exercised by the state over the location of canals in order that a systematic and economical distribution of the public water may be secured and monopolies of water prevented.

3. That no authority can attempt this so well as the local government, which has already supervision of the works built by private enterprise.

4. That much of our water will remain unutilized and large areas of land unreclaimed unless aid is extended in the construction of more expensive and difficult works. This will prove true of any systematic attempts at storing water to fully utilize the flow of our larger streams. It must be remembered that we are on the line of transcontinental railways and that our

farmers are brought into direct competition with those of Kansas, Nebraska and Iowa, who have no expenses for water to meet. This competition, therefore, limits the price which can be paid for water, and also the amount of money which can be invested in the works to provide it. If this is disregarded, either the parties building them will lose money or water rates will be so high as to make farming unprofitable. The government can well afford, however, to extend aid to enterprises of this character, since the permanent addition to the productive wealth of the country and the consequent return in taxation makes the outlay a wise one from a business standpoint.

WITHDRAWAL OF THE PUBLIC LAND.

The section of the law creating the irrigation survey which provides for the segregation of the public lands and their withdrawal from entry or settlement, has given rise to much solicitude. It reads as follows, the italics being mine:

"For the purpose of investigating the extent to which the arid region of the United States can be redeemed by irrigation, and the segregation of the irrigable lands in such arid region, and for the selection of sites for reservoirs and other hydraulic works necessary for the storage and utilization of water for irrigation, and the prevention of floods and overflows, and to make the necessary maps, including the pay of employes in field and in office, the cost of all instruments, apparatus and materials, and other necessary expenses connected therewith, the work to be performed by the Geological Survey, under the direction of the Secretary of the Interior, the sum of one hundred thousand dollars or as much thereof as may be necessary. And the Director of the Geological Survey under the Supervision of the Secretary of the Interior, shall make a report to congress on the first Monday in December of each year, showing in detail how the said money has been expended, the amount used for actual survey and engineer work in the field and in locating sites for reservoirs, and an itemized account of the expenditures under this appropriation. *And all lands which may hereafter be designated or selected by such United States surveys for sites for reservoirs, ditches or canals for irrigation purposes, and all the lands made susceptible* *f irrigation by such reservoirs, ditches or canals, are from this ime henceforth hereby reserved from sale as the property of the United States, and shall not be subject after the passage of this act o entry, settlement or occupation until further provided by law;* Provided, that the president at any time in his discretion, by proclamation, may open any portion or all of the lands reserved by this provision to settlement under the homestead laws."

The expression in italics, that all ditches and reservoir sites and all lands made susceptible of irrigation therefrom, that may hereafter be reserved, are withdrawn from the date of the act, (October 2, 1888), would seem to throw a cloud on the title of every land entry made in the arid region since that time. This would further seem to be the case from the language of the acting land commissioner in a circular issued August 5, 1889, which states:

"The object sought to be accomplished by the foregoing provision is unmistakable. The water sources of the arid lands that may be irrigated by the system of national irrigation are now reserved to be hereafter, when redeemed to agriculture, transferred to the people of the territories in which they are situated, for homesteads. The act of congress and common justice require that they should be faithfully preserved for these declared purposes.

"Neither individuals nor corporations have a right to make filings upon any lands thus reserved, nor can they be permitted to obtain control of the lakes and streams that are susceptible of use for irrigation purposes.

"You will therefore immediately cancel all filings made since October 2nd, 1888, on such sites for reservoirs, ditches or canals, for irrigating purposes, and all lands that may be susceptible of irrigation by such reservoirs, ditches or canals, whether made by individuals or corporations, and you will hereafter receive no filings upon any such lands."

No reservations have yet been made in this territory, but there is an unfortunate feeling of distrust and uncertainty for which there is some warrant, as shown in the instructions of the acting land commissioner to the register and receiver of the land office at Independence, California:

"Filings allowed for lands that may be selected as sites fo reservoirs, ditches or canals, or lands susceptible of irrigatio thereby, will be at the risk of the men filing."

The withdrawal of reservoir sites, so far as it operates t prevent speculative entries, is undoubtedly a wise provision, as i will prevent the work of the government being taken advantag of for the purpose of extorting blackmail from legitimate ente prises. But to arbitrarily withdraw all lands susceptible of irr gation would at present be a disaster to this territory. Nor do think that simply repealing all land laws but the homestead law as seems to be contemplated by this measure, would be advanta geous. Those familiar with the conditions in the portions of th territory remote from railways, are aware that the desert lan law has greatly stimulated development and that it is only b securing and cultivating large areas that either the constructio of ditches or the subsequent cultivation of the land has bee made profitable. While the desert land law is not an ideal meas ure, it has undoubtedly aided in the development of this territor and should not be repealed unless to give way to some equall efficacious and liberal measure.

STORAGE RESERVOIR SITES.

Owing to my time being fully occupied with work of a mor pressing character, and to the lack of means for its effectiv prosecution, I have made but few examinations of sites for storag reservoirs. I have examined a number of excellent sites in th Wind River mountains and on the lands bordering the easter tributaries of Green river. This locality affords the best natura opportunities for storage of any portion of the territory that have visited. There are also a large number of favorable site on both the North Platte and Laramie rivers. I have not sufficient information about the opportunities in other parts of th territory to venture any statements.

During the past season Mr. F. O. Sawin has been engage in making a survey of the public lands bordering on the easter tributaries of Green river and has kindly prepared the followin statement, describing some of the reservoir sites which he ha examined:

"In compliance with your request, I herein give, as nearly as practicable, the location, capacity, and possible usefulness, for irrigating purposes, of certain lakes in Fremont county which have fallen under my observation while engaged in n United States survey this past summer.

"First in importance in this group of lakes is Fremont lake, the length of which is variously estimated at from nine to twelve miles, located in townships 34 and 35 north, ranges 108 and 109 west, with a width from one and a half to two miles.

"Half Moon lake, in township 34, range 108, covers an area of about three square miles.

"Fayette lake, in township 34, ranges 107 and 108, covers an area of one-half a square mile.

"Boulder lake, in township 33, ranges 107 and 108, covers an area of five square miles.

"These lakes are situated at such an altitude, that by deepening the natural outlet, the streams which flow from them could be used advantageously, letting out a large amount of water. Their area could be considerably augmented by the construction of dams, material for which is contiguous and abundant.

"The average elevation of these lakes is about seven thousand five hundred feet. Their depth is unknown, but it is too great for all the water to be drawn off, although by deepening their outlets and by constructing dams to raise the present level a total depth of fifty feet could in one case at least be drawn off. Along all the streams flowing from them there are large bodies of land, desert in character, which could easily be reclaimed by irrigation."

"RESERVOIRS ALONG MEDICINE BOW."

"The next group of lakes that have fallen under my observation which could be used for irrigation purposes, are those of the Medicine Bow range, lying west of the Laramie Plains, and the sources of the Little Laramie and its tributaries, on the east slope. French and Brush and Pass creeks, on the south and north slopes; Medicine Bow and its tributaries on the west slope. These lakes cover many square miles, and by plans suggested as applicable for the improving of other lakes, their storage capacity can be largely augmented. The waters stored could be used on the Laramie Plains and on the Platte river and Pass creek table lands, which lands produce most bountiful yields under irrigation. It would be of great advantage if the Interior Department would employ an experienced and practical engineer to make a careful survey of the above mentioned lakes, and verify the observations I have thus briefly made, and I would suggest that you urge that these lakes be held in reservation for the purposes which nature seems so clearly to have designed them.

"This brief report is submitted with the modest hope that it may suggest matters worthy of insertion in your forthcoming report. With high esteem,

"F. O. SAWIN.

"P. S.—All of these lakes are abundantly supplied with mountain trout and other fish."

It may be explained that the majority of the sites for storing water are not located in or along the channels of running streams, but are natural depressions or basins, situated, in some cases, a considerable distance away. Their improvement, therefore, does not in the majority of cases involve the construction of dams or other works which imperil the lives or property of people living along the water courses. Two-thirds of the reservoirs now in use in this territory are either mountain lakes or natural depressions which have been filled by a ditch or canal leading from some natural stream, the water in many cases being carried for a considerable distance.

INVESTIGATION OF THE SENATE COMMITTEE

Early in the summer I was notified by the engineer of the senate committee, that the committee would reach Wyoming the latter part of September, and that Cheyenne would probably be their only stopping place. He asked that as far as possible, maps, plans and statements be prepared for submission to the committee as their stay would be brief.

The time at my disposal would not permit of any considerable work in preparing maps, but one, showing the dvision of the territory into water districts, was completed here and the Board f Trade of Laramie City prepared one showing the irrigation works on the Laramie Plains. Such statistics as could be gathered were tabulated and presented, among which were some valuable statements bearing on the cost of constructing ditches and of reclaiming land. These statements were prepared and forwarded to this office by some of the most experienced farmers n the territory.

Taking the statements of those responding to my inquiries s a basis, the expense of constructing ditches and distributing vorks in this territory has not fallen short of $5.00 per acre, making the total investment in irrigation works, at the present ime, about ten million dollars. The improvements on the lands hus watered, together with the outlay made in bringing the land nto proper condition for farming, must be nearly as great; so hat the total expenditure at present in irrigation works and gricultural improvements is considerably in excess of fifteen million dollars.

The arrival of the senate committee during the meeting of he constitutional convention made it possible for the committee o obtain the views of citizens of nearly every portion of the territory. Several members of that body appeared before them nd furnished much valuable information on the resources of their espective sections.

The following statement was also submitted from this office:

o the Honorable
The United States Senate Committee on Irrigation:

ENTLEMEN:

As the official head of the irrigation system of this territory have the honor to present to you this statement describing its gricultural resources and possibilities by the aid of irrigation; e character and extent of the work already performed; and of plaining the views of our people as to the measures necessary secure the full utilization of our water supply in reclaiming e unoccupied arid lands.

Among the arid commonwealths, Wyoming stands the third the extent of her irrigated lands, while, in the excellence of her ws and the legislative measures for the promotion of this interest, she deserves even higher rank. Although the younges of the territories and suffering greatly from the lack of railroad facilities, particularly between the agricultual districts of th north and the mines in the south, only California and Colorad surpass her in the mileage of canals or the area of land watered therefrom. This rapid development has been due to two causes the first being the exceptional natural advantages of the territor as a grazing region and which, at an early date, made the raising of cattle a most important industry. With the cattle men to ope the way and make settlement possible the farmer soon followed and as the necessity for winter feeding became apparent, th profits of the cattle business were invested in the construction ditches to enable such food supplies to be grown.

The second reason is found in the abundance of the wate supply and the ease and cheapness with which the waters of th streams can be diverted. It will be sufficient to state here tha the principal streams have their sources in mountains of sufficien elevation and extent to make them abundant accumulators an conservators of the needed moisture, and that from these natur reservoirs these fruitful arteries of our agricultural life penetrat every section of our broad area. No other arid state or territor equals this in the number of streams whose waters can be d verted, or in the uniformity of their distribution over its enti area. The location of the natural water courses is such that they carried a sufficient volume of water all the lands could b easily and cheaply watered, while, on the other hand, there but little land which would not be made productive if the wat could be had. Hence it is that no subject has to this Commo wealth the same ultimate importance as the proper storage an use of all water that falls on its surface.

The solution of the problem of how best to accomplish th involves an inquiry into two matters, first, the proper distrib tion of the water over the land, and second, the conservation an storage of the flood water and the water running to waste in th non-irrigating season. In considering these questions rega must be had to the works already built and of the metho adopted and in practice among the farmers of the territor since no methods can be successfully carried out which do not accord in a measure with the views and interests of those already in the work. While the area irrigated is far less than that awaiting reclamation, it is too important to be lost sight of in any plans for future work. The ditches now in operation and the acres of land which they water have involved the outlay of many millions of dollars of the earnings of our citizens. When they began their work the success of agriculture by irrigation was problematic. It was through their confidence and energy that the country now understands and appreciates its value and importance and it is their efforts which have given the arid region whatever value it has. Hence, no action should be sanctioned which does not promise to promote the financial success and prosperity of the works already constructed. While the northern part of the territory has outstripped all other portions in the extent and value of its irrigated lands, in all sections the construction of ditches has reached a surprising degree of importance and there is no portion in which the agricultural lands do not form an mportant part of the natural resources.

Much of the work done is faulty, resulting in heavy expenses or operation and maintenance and great loss of water in distribution. We have too many small canals watering the bottoms nd not enough large canals watering the uplands. Our methods nd system need reforming to prevent this in future work. It is the result, in part, of the lack of means and experience on the part of the pioneer ditch builders, but very largely, of late years, f the unfortunate circumstances of our land laws being wholly nsuited to the conditions of this region and of their administraon in some cases being in the hands of men ignorant of these acts.

It is a well settled principle that lessening the number of itches by building large high level canals results in both econmy of water and saving in operating expenses. It also, as a ule, secures the watering of more fertile and productive land. o build large ditches, however, requires either a unity of ffort on the part of the farmers owning the land or the introducon of capital to build canals to rent water. The first plan has ldom been successfully pursued. The length of time required to prepare for and complete the construction of a large canal an the fact that farmers can produce nothing to support themselve or their families until this is accomplished, has prevented its suc cessful adoption. Hence the majority of the large irrigatio works have been built as common carriers of water. This pla seems to best meet our conditions and needs. There is no objec tion, as far as I am aware, and many things in favor of this pla provided the canals are properly built and furnish water at reasonable rental. They are a necessary and valuable featur of our irrigation development, and we shall have such laws will make such investment safe and secure their construc tion under such conditions as will enable them to furnish wat to farmers at a minimum cost.

Unfortunately, however, the building of large canals furnish water to the settlers on the public lands gives rise to condition of affairs which, while well understood here, is appa ently not appreciated elsewhere. Before canals are built the lands are valuable only for grazing purposes, which value most cases does not exceed fifty cents per acre. The constru tion of canals, however, carries with it the assurance of the reclamation, enhancing their value to that of farming land; that without the purchase of a water right or without the own of these lands having in any way contributed to their impro ment their value is increased, at a low estimate, from five fifteen dollars per acre. This unearned increasement is due entir to the expenditure and efforts of the ditch company which e pects its return from the rentals of water to the settlers on t lands thus made susceptible of cultivation. If, therefore, all filin under the ditch were made by persons expecting to become c tivators of the soil, and who would at once become users water, no harm would ensue. Unfortunately, however, our la laws make possible an entirely different result. The increase value resulting from the construction of ditches is a rich fi for the speculator. Parties having no desire or intention of coming farmers, can, through the pre-emption law, the hom stead law, and the timber culture law, obtain possession of acres of land without having to rent a gallon of water fr the ditch company or in any way contributing to its maintaina or advantage. By the expenditure of 25 cents per acre they can in the same way obtain a three years option on 640 acres additional by desert entry. Thus it is that over a thousand acres of land is withdrawn from honest settlement and the speculator or entry man is in a position to blackmail the ditch company, as it s only by its buying him out and disposing of these lands to bona fide farmers that it can derive any income from the water supply. This situation of affairs has made it impossible in this territory to construct large ditches as common carriers of water. The success of the enterprise makes it necessary that the lands should at once be brought under cultivation, and to accomplish this there must be some control over their settlement. This neither the ditch company nor the territorial authorities can attempt at present.

There are in the territory a number of important canals built to rent water and all have suffered from the difficulty of securing a prompt settlement of the land reclaimed. Some of hese have endeavored to protect their investment by securing his control of the lands. The most important instance of this s the Wyoming Development company, its field of operaion lying about 90 miles north of this city. It began originally with the intention of furnishing water to farmers, but it soon became manifest that unless they could control the settlement of the ands the only parties to derive any benefit from their efforts would be the parties filing on the land and that if the lands were o actually be made productive they must take steps to control heir settlement. This was done, and in this work and the construction of their canal about one-half a million of dollars was expended. The enterprise has been in every respect a most praiseworthy one. Over 50,000 acres of land have been watered by one of the best systems of canals to be found anywhere in the arid region, yet owing to the lack of appreciation of the real situation of affairs, and of the necessities of this region, these lands e idle and unproductive in the hands of the government and the projectors of one of the best enterprises yet inaugurated in this territory have been put to the expense and annoyance of maintaining for five years a system of costly and unproductive irrigation works. The unfortunate outcome of this company's oper tion has been in the widest sense a disaster to the territory. I example is a menace and a virtual barrier to the inauguration o other enterprises of special magnitude and has resulted in a re turn to the original practice of building small ditches where eac individual could manage and control his own claim. The oppo tunities presented for the diverting of water makes possible a extraordinary development of this nature. The evil consequence of this state of affairs are many. It creates a system difficult t control, expensive to operate, and wasteful of water. Not onl that, but many of our best lands can only be reclaimed throug the medium of extensive and costly works. If during the pa five years we could have had a system of land laws that woul have enabled ditch companies to have secured actual settlers o the lands reclaimed, the number of important irrigation work and the extent and wealth of the irrigated territory would b four fold that which exists.

A proper utilization makes it desirable that additional chang besides reforming our land laws should at once be made. Sinc the area of land which can be irrigated is greater than the avai able volume of water, it is desirable that our irrigation work should be so located as to serve the best of these lands and th the water supply should be so distributed as to insure the utmo economy in its use. To do this it is necessary that a careful ex amination of the streams be made in advance of irrigation co struction, and that these works should be built in accordance wi an intelligent system and plan. It is further to the interest of th state that this should be done, since it is charged with the respo sibility and expense of supervising these works after they a built, and with the division of water among the various claimant Under the haphazard system which has hitherto prevailed, whe there has been no limitation or supervision as to the numbe location and character of the works for diverting water, it be comes a practical impossibility to secure a just or satisfactory di tribution of the water supply in a time of scarcity.

The ill results of this policy become more prominent th longer pursued. They are more notorious in Colorado than wi us and will be felt here in ten years far more than at present. It is a counterpart of the old land system, or lack of system, which formerly prevailed in this country and some of the eastern and southern states where each settler blazed out his domain, according to his inclination, regardless of the boundaries or rights of his neighbors. The litigation and ill feeling which followed as a legacy of this practice in Kentucky and other states, promises to be repeated in our water right troubles if some more enlightened policy be not adopted. That our system is what it is is not due to the lack of an appreciation of its defects on the part of our people or the want of knowledge of a remedy It is a system forced upon us by necessity, not choice. A territory sparsely settled, with its resources undeveloped, was not in a situation to undertake any systematic public improvement or investigations, nor can we accomplish anything satisfactory towards this end with the public lands owned and controlled by the general government. It is useless to make any investigation or examination as to the proper location of irrigation works while no control can be exercised over the settlement of land.

The most satisfactory remedy for this state of affairs, and in my judgment the only efficient one, is for congress to grant to each state of the arid region, or to each territory upon becoming a state, all the irrigable land within its borders held by the general government, such state to be charged with the supervision of their reclamation and with their disposal to actual settlers.

The reasons for asking this donation were stated in a letter prepared by a committee appointed at a conference held in this city in July last and I can do no better than repeat them here.

"First. The reclamation of the lands of this region imposes upon the people engaged, and upon our local and state government, requirements and expenses not encountered by the pioneers of the humid portion of the country. Not only does the construction of ditches, and other distribution works, add greatly to the first cost of the farm, but with their multiplication comes the necessity of the state assuming control of the distribution of the water supply and its failure to do so leads inevitably to expensive litigation or to personal controversies which impair both the success and the growth of our agriculture. A further incentive to prompt action is the fact that the area of the land susceptible of reclamation exceeds the amount of the water supply. The water, therefore, possesses a greater value than the land and on its economical distribution rests the limit of our future agricultural wealth. It is of the utmost importance, therefore that no wasteful or improper distribution be permitted, and that the state should control the appropriations of water as well as its subsequent division among the various claimants. The expense of this work must of necessity be heavy. In Wyoming there are already 2,500 ditches drawing their supplies from 400 water courses and this work is yet in its infancy. In Colorado with its greater advancement the single work of regulating the division of the water supply requires the employment by the state of nearly one hundred men. This regulation is a necessity not to be avoided, but the preliminary examination of our streams and as efficient supervision of the construction of works to divert the water is of equal importance to our future welfare. In our present condition it will, however, be a practical impossibility for many of the states and territories to provide means for this work by taxation, but the funds for its prosecution can be easily provided for in the disposal of the lands whose donation is asked.

"Second. Our experience during the past five years has shown the evils growing out of the control of the lands being under one authority and the water under another.

"If this territory could during the past five years have controlled the disposal of the irrigable lands within its borders, it could, while disposing of it to actual settlers only, have afforded such protection to canal companies as would have given to our agriculture four times its present importance and more than doubled our population. Instead of this, there have been repeated instances where arbitrary and unreasonable rulings have subjected our people to heavy and wholly unnecessary expense and to cause the whole land policy to be regarded as oppressive. It was, however, the inevitable result of land laws wholly unsuited to the needs of irrigation, and of their enforcement by officials in Washington, whose experience had not prepared them to deal with the conditions which exist here.

"It is also impossible for Congress to pass a general law which will operate with equal justice and success on the arid belt as a whole. The conditions differ in the different sections, as do our water laws. Wyoming differs from Utah, and Arizona from Montana or Idaho. The people of each section are the best calculated to determine the system best suited to their needs and should be given the means of carrying it into effect.

"Third. The results already achieved are a sufficient guarantee of what can be accomplished under favorable circumstances. Our legislation as to water has, on the whole, been wise, but it can never have the stability or success which would come with the control of both water and land. Our engineering works have elicited the praise of experts from other irrigated countries for both their economy of construction and adaptation to their use. At present the practical knowledge of the subject is almost wholly confined to those engaged in the work. The information gained through the labors and investigations of the geological survey can be utilized by the local legislatures, while by placing the responsibility for this work upon our people a great impulse will be given to the diffusion of intelligence on the subject and to local pride in the character of our irrigation works. It will put the solution of this problem in the hands of the people best informed on the subject and most interested in its success.

"We will say further that our people are afraid of the proposed withdrawal of the irrigable lands from settlement or the placing of the construction and control of our irrigation works under the charge of the national government. The reason being in both cases that the delay and uncertainty which would be inseparable from such action would be disastrous. While the passage of laws to encourage individuals or companies to reclaim large bodies of arid lands would most speedily accomplish the desired end, namely, reclamation and settlement of the arid regions, yet public sentiment seems to be so adverse to this plan that we feel that it is scarcely worth our while to advance it."

The dangers attendant upon national legislation is shown in that clause of the law creating the irrigation survey which provides for the repeal of all land laws except the homestead act.

This clause has met with the disapproval of all persons acquainte with the situation in this territory. To limit the acquirement o title to the public lands to the provisions of the homestead ac would be a disastrous restriction on settlement and there is n valid reason for its adoption. It offers no aid toward the construction of better works or the more economical diversion o water, the most important consideration connected with the who subject. In this respect the desert land law was the best eve enacted, if it had been liberally construed or if the rulings of th land office had been uniform as to its meaning. The difficult has been that the changes in the rulings have been of so radica a character as to practically constitute new legislation and t cause much hardship and expense to those honestly endeavorin to comply with the law. So onerous have been some of the restrictions that it has seemed as though the authorities regarde every claimant of the public land as an object of suspicion wh was guilty until proven innocent. It is time that a more sensib and just conception prevailed. Every settler on these land which in their present condition have no agricultural value, an who reclaims them and makes them productive is a benefact of the whole country and should receive the most liberal treatment. Instead, however, after having expended from five t fifteen dollars per acre in bringing the water on his land an preparing it for irrigation, he is compelled to pay the same pri therefor that the settler on the broad prairies of Iowa and Kans paid for land already prepared for the plow. The commonwealths who are charged with the duty of guarding the pub welfare should be aided in their efforts. Every considerati which justified and secured the donation of the swamp lands the states of the humid region applies with greater force to t advisability of a similar donation of the arid lands to the seve states and territories interested. Not only are our local governments charged with heavy duties and responsibilities which no of the humid states had to confront, but the settlers who co here to engage in farming undertake the practice of an art who mastery is both complicated and difficult and of which they ha had no previous experience. Our climatic conditions are exc tional, making much of our agriculture an experiment, and making certain that we are far from pursuing the best methods or that we are achieving anything like the results possible. The local government should aid private effort by conducting experiments to determine the best methods and by disseminating information which will enable new comers to obtain their knowledge of the subject by some less costly and difficult road than that of experience. The success of irrigated agriculture enormously increases the value of the arid domain and will be an important contributor to our national wealth and prosperity. The best results can only be secured through the nation's aid. I trust it may be generously extended.

Respectfully submitted,

TERRITORIAL ENGINEER.

WANTED, MORE FARMERS.

We are at the present time in a transition period in whic the range cattle business, as the leading industry, is giving wa to a profitable combination of farming and stock raising. Such change is attended by more or less uncertainty and discomfo and the sooner completed the greater will be resultant prosperit The immense territory over which irrigation is distributed i Wyoming makes the hastening of change obviously importan In many sections the building of railroads, the erection of mil and the creation of markets for produce all await an increase i the agriculural population.

At present the chief products are those that can be marketed without these aids, the most important being oats and ha tor the winter feeding of stock. The statistics of production ar too meager to be given, but the amounts are great and can b increased to an indefinite extent.

No part of the country offers a better field for the hom seeker than Wyoming. There are opportunities for engagin in almost every branch of agriculture under the aid and assuranc of the bountiful returns which come only through irrigatio while the profits of farming can be supplemented by the use o a vast extent of free grazing lands.

Taking the results obtained by our farmers in the limite time which has elapsed since farming became an important i dustry here, it is doubtful if any section of the country can ma a better exhibit. During the present year a number of comp titions have been held to secure the largest yield of the princip crops. These were participated in by the leading farme throughout the country, and the fact that the representatives this territory captured a number of the prizes and held high ra in all is cause for congratulation. In these competitions yields of 434 and 1015 bushels of potatoes and 90 bushels of oats per acre were secured.

The experience of the past two or three years has also done much to remove the prejudice heretofore existing against the more elevated portions of the territory. At the last territorial fair the two displays of wheat which captured the two first premiums were grown on the Laramie Plains at an elevation of 7,000 feet and on Crow Creek at an elevation of 6,500 feet. The premium barley was grown at an elevation of 8,000 feet. Grapes grown in Cheyenne, at an elevation of 6,000 feet and apples from four counties of the territory prove that fruit culture is already an accomplished fact.

MARKETS.

Owing to inadequate transportation facilities, the market for agricultural products in some portions of the territory is not so stable nor are prices at all times as satisfactory as could be desired. Such is not the case, however, in the southern portions of the territory; where the market afforded by the mining and manufacturing towns along the line of the Union Pacific Railway creates a demand in excess of the supply.

To show this a table has been prepared from data furnished by the Burlington and Union Pacific Railways. This is incomplete, as it does not include shipments by express companies, but shows that the territory is each year being drained of a surprisingly large sum of money in the purchase of the very articles we should produce in excess. No country surpasses this in the natural advantages afforded for dairying, the growing of many classes of garden products, or the production of grain and hay, and our paramount need is men to take hold of the work.

The prices quoted are intended as an average and were kindly furnished by the Union Mercantile Co., of Cheyenne.

Table showing importations of farm products, by railway, into Wyoming, during the year ending September 1, 1889:

ARTICLE.	QUANTITY.
Wheat	577,650 lbs
Corn	2,850,040 lbs
Oats	6,845,370 lbs
Hay	9,166,900 lbs
Flour	6,616,050 lbs
Fruit and Vegetables	5,483,600 lbs
Bran, Meal and Chop	2,609,630 lbs
Packing House Products	912,970 lbs
Butter, Eggs, Poultry, etc	471,540 lbs
Total	35,533,800 lbs

Table showing average price of the following list of farm products at Cheyenne, Wyoming, during the year ending September 1, 1889:

ARTICLE.	PRICE.	REMARKS.
Lard	6.5 to 10.5 cents	In tierces.
Wheat	$ 1.25 to 1.75 cwt	
Flour	2.00 to 2.90 cwt	Colorado, best grade.
Oats	.85 to 1.20 cwt	Good quality, Nebraska.
Corn	.60 to .95 cwt	" " "
Chop	.70 to 1.00 cwt	" " "
Meal	1.09 to 1.25 cwt	
Bran	.65 to 1.10 cwt	Best Colorado.
Beans	3.00 to 4.25 cwt	Hand picked, navy.
Hay	8.00 to 10.00 ton	Good quality, Nebraska.
Potatoes	.70 to 1.00 cwt	Native or Colorado.
Butter	.20 to .30 lb	Home creamery.
Cheese	.10 to .13 lb	Strictly full cream.
Eggs	.10 to .30 doz	
Apples	3.00 to 3.75 bbl.	

The source of statistics on articles imported do not permit an exact estimate of the money paid out to adjoining states for supplies we should produce at home. A few facts can be given and are suggestive. Taking the average of the prices given it will be seen that the purchases of oats and hay from Nebraska and Colorado for this year amount to over $100,000. The expenditure for butter, eggs, and poultry has been fully one-third more. If to these we add the money paid for vegetables, flour, and packing house products, we have fully half a million of dollars of a drain on our resources expended for articles that could have been just as profitably and successfully produced at home if we had the men engaged in supplying the demand.

These products could have been secured within our borders if there were transportation facilities to the northern and central portions. There is no necessity, however, for their having been shipped at all as there is an abundance of unoccupied agricultural land contiguous to these markets.

BOUNDARIES OF IRRIGATION DISTRICTS.

District Number One.—Consists of all lands irrigated from ditches from the North Platte river and its tributaries, except the Laramie river, between its intersection with the boundary line between Nebraska and Wyoming and its intersection with the boundary line of Laramie county, Crow creek, Lone Tree creek, Pole creek, Horse creek, Chugwater creek, Cheyenne river, Niobrara river, and their tributaries.

District Number Two.—Consists of all lands irrigated from ditches taking water from the Laramie river and its tributaries, except Chugwater creek, North Platte river and its tributaries between its intersection with the western boundary line of Laramie county and the mouth of the Sweetwater, Sabille creek and North Laramie creek, and also the following named streams situate in whole or in part in the county of Albany, namely: Douglass creek, Lake creek, the three Beaver creeks, Four-Mile creek, Dutton creek, Cooper creek, Rock Creek and tributaries, Sabille creek, Sheep creek, Deer creek and tributaries, Dale creek and tributaries.

District Number Three.—Consists of lands irrigated from ditches taking water from the North Platte river and its tributaries to the line of Carbon county, and all streams or continuation of streams within Carbon county.

District Number Four.—Consists of all lands irrigated from ditches taking water from Green river and its tributaries

District Number Five.—Consists of all lands irrigated from ditches taking water from Powder river and its tributaries to the Sheridan County line, and all of the Big Horn river and its tributaries that are within the limits of Johnson County.

District Number Six.—Consists of all lands irrigated from ditches taking water from the Little Powder, Little Missouri Belle Fourche rivers and their tributaries.

District Number Seven.—Consists of all lands irrigated fro ditches taking water from that portion of Green River lyin within Uinta County, and Bear river.

District Number Eight.—Consists of all lands, ditches an streams in Fremont County.

District Number Nine.—Consists of all lands, ditches an streams within the boundaries of Sheridan County.

By proclamation Governor Moonlight created the lands irr gated from Salt river and its tributaries an irrigation distri which was heretofore known as District Number Nine.

Note.—The table giving streams from which water has been diverted fo irrigation and names of ditches diverting water therefrom, with their capacit area watered and date of claim of appropriation is omitted in the published r port, although included in the report to the governor.

LEGISLATION.

CHARACTER OF EARLY WATER RIGHT LAWS. WATER RIGHT DECREES. ARTICLE VIII, CONSTITUTION STATE OF WYOMING. RECOMMENDATIONS. MINOR CHANGES IN THE LAWS.

EARLY LEGISLATION.

The present water right laws in Wyoming are the result of an evolution having its impulse in the requirements which the construction of ditches and the multiplication of claims to public waters have produced. The direction of this evolution has been largely affected by the lack of means on the part of the people to inaugurate a comprehensive system of control and by the desire to await the admission of the territory to statehood before attempting to formulate a permanent code. As a result legislation has been of a temporizing and fragmentary character, the aim being to provide for the immediate necessities rather than anticipate future needs.

That legislation should have been of this character was almost inevitable. The earlier years were seasons of heavy expenditure for the construction of ditches and provision for the payment of land and its subsequent reclamation. With heavy outlay and small returns there was a natural desire to limit the taxation for supervision to the smallest possible amount, but the important and unexpected extention of the irrigated territory has necessitated constant changes in laws to provide for the protection of rights and to meet the increasing complications. As a result, while the repeal of inadequate and unwise statutes and the enactment of supplemental laws has resulted in some contradictions and some vital omissions, taken as a whole, Wyoming has the most advanced and comprehensive water right laws of any of the arid states or territories.

To have succeeded to this extent is a record worthy highest commendation. Water right legislation has taxed the ablest minds of the irrigation states of Europe in the solution of the complicated questions to which irrigation gives rise. While I do not believe that our present laws would serve in the future, they have imparted impetus to development and given security and stability to irrigation investments. The defects which are manifest in our present system have a common origin, which was the delay in creating a special bureau of Board of Control of water right matters and instead entrusting their care and direction to officers fully burdened with other duties and having no special acquaintance with the subject, and feeling no responsibility for its successful management. There was apparent economy and expediency in making the county clerk recorder of claims, in having the county surveyor measure the ditches on which they are based and the district judge determine their validity. No new offices were created. There were no salaries to be paid. but the irrigator soon found that the fees sustaining this arrangement were a burden more grievous than would have resulted from the complete equipment of a proper system of control in the hands of officers properly recompensed. That the present system is not economical needs no argument with those who have complied with all the requirements. On investigating this subject I learned that the owners of ditches on two streams in this (Laramie) county have paid in fees for recording claims, measurements of ditches and expenses of adjudication over $10,000. These expenses were no greater than would be required in the adjudication of other streams, but no one who studies the subject can believe that a system that makes them necessary is a proper one, or can favor the extension of its workings to the hundreds of other streams not yet adjudicated.

After expense the second objection is the cumbersome method and in many cases unsatisfactory character of its results. A present the irrigator must run the gauntlet of the county clerk's office, the district court, the engineer and the water commissione before he receives any benefit or protection; and between all he becomes hopelessly confused. The present method of recording claims is unwise because they are of no use in the county clerk's office and it is difficult and expensive for those who must use them to become familiar with their contents. The settlement of water right priorities and allotment of water by the courts have been exactly similar to the judicial decisions which might be expected from a supreme court composed of farmers or engineers. In other words, judges have been compelled to settle questions which require special knowledge and experience outside their profession and involving problems which they had neither time nor opportunity to properly investigate. In the comments on these decrees hereafter, I wish to disclaim any intention to reflect on the care exercised in their preparation. I simply desire to enforce the statement that cannot be too often or too strongly reiterated, that the questions involved in the management and disposal of the public water are too complex and difficult to be settled by any except officers of special training and experience, and that so long as sources of information and authority are divided up among three or four disconnected and disinterested offices so long will the administration of laws be difficult and unsatisfactory.

WATER RIGHT DECREES.

The first judicial appropriation of water in the territory was the decree adjudicating priorities on Bear Creek, rendered by Judge Maginnis, in which, however, the rights of only six out of forty-two recorded ditches were determined. After this came the decrees on Crow creek, Clear creek and Horse creek in Laramie county, Baldwin creek in Fremont county and Crazy Woman creek in Johnson county, in all six decrees.

The most important of these decisions was in relation to Crow creek. This stream supplies the city of Cheyenne and, in addition, seventy-five irrigation ditches. Its waters are therefore quite valuable and, as the stream has been largely over appropriated, there has been considerable difficulty experienced in securing a proper distribution. Immediately after the rendering of this decree there was a demand for the services of the water commissioner and I was required to prepare his instructions in accordance with Sec. 9, Chap. 55, Session Laws of 1888, which reads as follows:

"Sec. 9. In all cases in which the priorities to the right to the use of the waters of any of the streams of this territory have been adjudicated by any of the district courts of this territory, under the provisions of chapter two of title nineteen of the Revised Statutes of Wyoming, it shall be the duty of the clerk of the district court wherein such adjudication may have been made to forward a certified copy of such decree to the territorial engineer immediately after the rendering of a decree in the matter of of such adjudication, and for such copy there shall be paid to the said clerk, out of the treasury of the county wherein such decree was rendered, compensation at the rate of ten cents for each one hundred words contained in such decree. On receipt of such copy of such decree, it shall be the duty of the territorial engineer to cause the same to be recorded at length in a suitable book to be provided for that purpose, and as soon thereafter as practicable to forward to the water commissioner of the water district wherein the stream adjudicated upon is situated, a statement showing the title of the court in which such decree is rendered, the date of the decree, *the name of each ditch the priority of which has been by such decrees determined, its capacity, showing the width, depth and grade of the said ditch and the quantity of water per second of time to which said ditch is declared by such decree to be entitled, to be expressed in cubic feet per second of time* and thereafter, in the supervision of the distribution of the water of such stream by said ditches so adjudicated upon, it shall be the duty of said water commissioner to be guided by such statement."

An examination of the decree showed, however, that it did not contain sufficient information to enable me to comply with the specific requirements of the law, since the names of the ditches were not given, only one ditch being named in the entire document. Neither were there any definite allotments of water with the sole exception of the city of Cheyenne. The decree

herefore, does not comply with the provisions of section 1345,
Revised Statutes, a part of which reads as follows:

"The court, or judges thereof, in vacation, shall without
nnecessary delay, by an order to be entered of record upon such
notion, petition or application, appoint a day, in some regular
erm of said court, or in vacation thereof, for commencing to
ear and take evidence in such adjudication, at which time it
hall be the duty of the court or the judge thereof, in vacation,
o proceed and hear all evidence that may be offered by or in
ehalf of any person, association or corporation interested in such
tream or streams in such district, in any ditch, canal or reser-
oir, either as owner or consumer of the water therefrom,
n support of or against any claims of priority of appropria-
ion of water made by means of any ditch, canal or reser-
oir, or by any enlargement or extension thereof in such district,
r on such stream or streams, and consider all such evidence,
lso the arguments of the parties or their counsel, and shall as-
ertain and find from such evidence, as near as may be, the date
f the commencement of said ditch, canal or reservoir, together
ith the original size and carrying capacity thereof as originally
onstructed, the time of the commencement of each enlargement
r extension thereof, if any, the diligence with which the work
as in each case prosecuted, the nature of the work as to the
ifficulty of construction, and all such other facts as may tend to
how compliance with the law in acquiring the priority of right
laimed for each such ditch, canal of reservoir, and determine the
atters put in evidence, and make and cause to be entered a de-
ree determining and establishing the several priorities of right
y appropriation of water, of the several ditches, canals or reser-
oirs, in such water district, on such stream or streams, concern-
g which testimony shall have been offered, each according to
e time of its said construction and enlargement or enlargements
d extensions, with the amount of water which shall be held to
ave been appropriated by such construction and enlargement or
xtensions, describing such amount by cubic feet per second of
me (which shall also be the method of measurement for the
le of water,) if the evidence shall show sufficient data to ascer-
in such cubic feet, and if not, by width, depth and grade, and

such other description as will most certainly and convenientl show the amount of water intended as the capacity of said ditch, canal or reservoir in such decree."

The decree gave nothing specific except the name of the individual to whom the water was given. To better explain th difficulties which it presented, the first four paragraphs of it findings will be given, the remainder being simply repititions s far as the form is concerned.

"The court finds the following persons entitled to the water of North Crow creek, in the order in which they named, subjec to the rights of persons below them on the main stream.

"1st. The North Crow Land and Cattle company is firs entitled to water sufficient to irrigate 100 acres of land, not t exceed 4.5 cubic feet per second of time:

"2nd. Philip and James Dater are entitled to water sufficient to irrigate 100 acres of land, not to exceed 3.02 cubic fee per second of time.

"3rd. Philip and James Dater are entitled to water sufficient to irrigate 110 acres of land, not to exceed 7.67 cubic fee per second of time.

"4th. Philip and James Dater are entitled to water sufficient to irrigate 30 acres of land, not to exceed 2.06 cubic fe per second of time."

It will be seen that neither the name, dimensions nor capacity of the ditch by which this water is to be utilized are give How the ditch of the North Crow Land and Cattle Compan shall be located, becomes an interesting problem. It was eve more puzzling with priority No. 2, since the parties to who the appropriation was given had half a dozen ditches on th stream and there was no way of determining their order.

Owing to these omissions and to what I considered oth defects in this decree I endeavored to have it reformed but di not succeed and, being doubtful about my authority to prepar instructions on unofficial information, I addressed an inquiry t the attorney general as to the sufficiency of the decree and m authority in the matter. The following is the reply:

ATTORNEY GENERAL'S OFFICE,
CHEYENNE, April 25th, 1888.

DEAR SIR: I have the honor to acknowledge the receipt of your favor of the 23rd inst. Replying to the same I beg leave to say that the decree rendered in the first judicial district touching the priorities of water rights on Crow creek, is not sufficient to give the necessary information to you so as to enable you to prepare instructions for the guidance of the water commissioner in accordance with section 9, chapter 55, of the Session Laws of 1888.

Accompanying this I return to you the copy of the decree rendered by this court, for which many thanks. Upon examination of the same, I find that the vital points to be decided in these cases have not been brought to the attention of the court and therefore have not been adjudicated. I have given notice to several attorneys interested in the case in which this decree has been rendered, calling their attention to section 1345 of the Revised Statutes of Wyoming and have asked them to take immediate steps, on the return of the chief justice, to have said decree opened and revised so as to lay down the proper instructions under which you are to furnish a guide to the water commissioners. Until this has been done I don't see anything that can be done by you to further the objects of this law.

Of course if the settlers on the creek should amongst themselves agree upon the several priorities, and come to you to ask you to make measurements and calculations for their respective lands and the necessary amount of water needed by each of them, you could go ahead and comply with their wishes and furnish instructions to your commissioner as you would deem meet.

I realize the importance of this question, that the commissioner should have his instructions laid down to him so plain under the decree of the court that there could be no question raised in the future as to the mode of the distribution of the waters of any stream, and I am satisfied that the same opinion is held by our chief justice, and had these defects been called to his attention by party litigants or otherwise, he would certainly cause the same to be revised at once. Respectfully submitted,

H. DONZELMAN,
Attorney General.

Nothing was done to reform the decree and the urgent demand which existed for some action led me to request of the district judge copies of the data used in its preparation, and from an examination of these a table of ditches, their order of priority and the allotment of water to each was prepared and used by the water commissioner in his work. The basis of the allotment, with all except priority No. 1, was one cubic foot of wate per second to each one hundred acres of land. This allotmen is probably below the actual needs of the land and was not intended as permanent, but rather regarded as an equitable adjustment for periods when the supply is inadequate. No opportunit has been given to judge as to the adequacy of this allotmen since the unusual scarcity of the past two seasons has prevente all except the oldest priorities receiving the designated amoun

Below are given tabular summaries of the decrees rendere to date showing the order of priorities of the different ditche the land watered by each and the allotment of water therefor.

NOTE.—In part of the decrees rendered the maximum amount to which a individual receiving the appropriation is entitled is given, it being left to the territorial engineer to reduce these amounts if they are regarded as excessive. Th however, practically nullifies the decree and gives rise to unending controversi

WATER DISTRICT NO. 1.

TABLE NO. 1.

Giving the date of appropriation and order of priority, the number of acres watered and the amount of each allotment, in cubic feet per second, for the ditches diverting water from Crow Creek; as established by the decree of the court of the first judicial district, dated day of March, 1888.

NAME OF DITCH.	NAME OF APPROPRIATOR.	Priority Number	DATE OF APPROPRIATION	Number of Acres Watered.	Allotment of water Cu. ft. per sec.	Total volume of water allotted Cu. ft. per sec.
Not given.	City of Cheyenne	1	Not given.		12.481	12.481
"	C. P. Organ and F. M. Phillips	2	"	100	6.92	19.401
"	R. B. Anderson	3	"	200	23.10	42.501
"	Anon Simmons	4	"	28	11.36	53.861
"	Wyoming Hereford Association	5	"	140	3.64	57.501
"	F. Farrel	6	"	300	5.12	62.621
"	F. M. Matthews, et. al.	7	"	100	6.20	68.821
"	C. Seevers and Berger	8	"	25	7.29	76.111
"	H. Oelrich	8	"	50	5.37	81.481
"	A. Gilchrist	9	"	260	12.66	94.141
"	F. Matthews, et. al	10	"	100	6.20	100.341
"	A. Gilchrist	11	"	50	3.90	104.241
"	F. H. Stone	12	"	120	2.44	106.681
"	N. Crow Land and Cattle company	12	"	100	4.50	111.181
"	C. P. Organ and F. M. Phillips	13	"	200	33.76	144.941
"	Claus Seevers	14	"	30	1.00	145.941
"	A. H. and T. B. Hord	15	"	160	3.77	149.711
"	A. and Mary Gilchrist	16	"	680	37.50	187.211
"	A. Gilchrist	17	"	100	8.00	195.211
"	A. Gilchrist	18	"	50	6.60	201.811
"	Wyoming Hereford Association	19	"	400	9.40	211.211

Not given.	P. and J. Dater	20	Not given.	100	3.02	214.231
"	P. and J. Dater	21	"	110	7.61	221.901
"	P. and J. Dater	22	"	30	2.06	223.961
"	A. Gilchrist	23	"	350	14.17	238.131
"	N. Crow Land and Cattle company	24*a*	"	120	4.18	242.311
"	A. Gilchrist	"	"	400	7.81	250.121
"	City of Cheyenne	"	"	60	4.50	254.621
"	J. H. O'Neil	24*b*	"	200	31.90	286.521
"	Vantassell & Company	25	"	1620	10.98	297.501
"	Anon Simmons	26	"	32	1.94	299.441
"	Anon Simmons	27	"	20	4.22	303.661
"	N. Crow Land and Cattle company	"	"	35	2.00	305.661
"	H. Oelrich	28	"	50	2.90	308.561
"	H. Oelrich	29	"	50	5.01	313.571
"	M. A. Arnold	30	"	100		313.571
"	F. Ketchum and J. Bergan	31	"	100	7.20	320.771
"	Helen Jenkins	32	"	10	2.00	322.771
"	C. P. Organ, et. al	33	"	500	14.40	337.171
"	Crow Creek Ditch and Reservoir Co.	34	"	220	9.00	346.171
"	A. H. and T. B. Hord	35	"	200	8.34	354.511
"	Wm. Phillips, et. al	35	"	60	3.33	357.841
"	Newton Bond	37	"	15	1.50	359.341
"	M. A. Arnold	38	"	100		359.341
"	Organ Ditch Company	39	"	5000	26.80	386.141
"	A. Gilchrist	40	"	60	7.22	393.361
"	Beaver Dam Ditch company	41	"	125	10.00	403.361
"	N. Crow Land and Cattle company	42	"	300	6.25	409.611
"	G. W. Baxter	43	"	750	32.00	441.611
"	N. Bond	44	"	20	1.29	442.901
"	F. Farrel	"	"	400	6.12	449.021
"	A. Gilchrist	45	"	400	10.00.	459.021
"	G. Morgan and C. P. Organ	46	"	220		459.021
"	Hereford Home Ditch company	47	"	900		459.021
"	F. Matthews	48	"	70	3.31	462.331
"	Iver Johnson	49	"	150	4.22	466.551
"	Eliza Kuykendall	50	"	260	12.50	479.051
"	A. Gilchist	51	"	1000		479.051
"	Silver Crown Ditch company	52	"		.194	479.245

WATER DISTRICT NO. 8.

TABLE NO. 2.

Giving the date of appropriation and order of priority, the number of acres watered and the amount of each allotment, in cubic feet per second, for the ditches diverting water from Baldwin creek; as established by the decree of the court of the third judicial district, dated the 18 day of July, 1888.

NAME OF DITCH.	NAME OF APPROPRIATOR.	Priority Number	DATE OF APPROPRIATION	Number of Acres Watered.	Allotment of water Cu. ft. per sec.	Total volume of water allotted Cu. ft. per sec.
Harting and Sharp	J. McLaughlin, H. Harting	1	Not given.	Not given	34.50	34.50
Lunn Williams and Sharp	E. Gustin, E. Tweed	2	1875		12.66	47.16
St. John Ditch	E. St. John	3	Spring 1887		15.20	62.36
Harris and Myers	Orrin O. Myers, et. al	4	Spring 1881		9.00	71.36
Wroe Ditch	G. Wroe and R. Barby	5	Fall 1881		5.33	76.70
Lunn Williams and Sharp	E. Gustin, E. Tweed	6	Fall 1881		25.66	102.36
Fisher No. 1	A. and J. Fisher	7	April, 1882		5.75	108.11
Fisher No. 2	A. and J. Fisher	8	May, 1882		8.00	116.11
Harris and Myers	Orrin O. Myers, et. al	9	Spring 1882		9.00	125.11
Grummitt Ditch	Orsen Grummitt	10	Spring 1883		7.80	132.91
Peterson Ditch	Louis Peterson	11	Fall 1884		15.00	147.91
Harting and Sharp	J. McLaughlin, H. Harting	12	Fall 1884		11.50	159.41
Jones Ditch	W. A. Jones	13	April, 1885		3.47	162.88
Jones Ditch	W. A. Jones	14	April, 1886		1.73	164.61
Julia Ditch	W. A. Jones	15	April, 1887		5.00	169.61

WATER DISTRICT NO. 5.

TABLE NO. 3.

Giving the date of appropriation and order of priority, the number of acres watered and the amount of each allotment, in cubic feet per second, for the ditches diverting water from Crazywoman creek, and its several tributaries; as established by the decree of the court of the second judicial district, dated the day of 1888.

NAME OF DITCH.	NAME OF APPROPRIATOR.	Priority Number	DATE OF APPROPRIATION	Number of Acres Watered.	Allotment of water Cu. ft. per sec.	Total volume of water allotted Cu. ft. per sec.
Not given	J. A. Dowlin	1	Not given.	160	8.65	8.65
John R. Smith Ditch	Jno. and Agnes Smith	2	"	1200	67.03	75.68
North Fork Ditch	Wyoming Land and Cattle company	3	"	800	30.	105.68
Harris No. 1	W. Harris	4	"	150	12.2	117.88
Kingsbury No. 1	D. A. Kingsbury	5	"	160	3.75	121.63
Holt Ditch	Wyoming Land and Cattle company	6	"	150	8.20	129.83
Red Bank Ditch	B. J. and J. M. Scott, et. al	7	"	800	37.4	167.23
Moreton Ditch	Moreton Frewen	8	"	400	22.32	189.55
Cook Ditch	Orrin Cook, et. al	9	"	3300	33.55	223.10
North Fork, Crazywoman Ditch	J. A. Dowlin	10	"	300	28.00	251.10
Muddy Creek Ditch	J. A. Dowlin	11	"	300	8.4	259.50
PX Ditch	C. Basch and O. Speral	12	"	200	17.9	277.40
Kingsbury No. 4	D. A. Kingsbury	13	"	300	2.35	279.75
Kingsbury No. 3	D. A. Kingsbury	14	"	300	2.25	282.00
Kingsbury No. 2	D. A. Kingsbury	15	"	160	3:6	285.60
Kennedy Ditch	R. Kennedy, et. al	16	"		32.	317.60
Dick Ditch	M. Frewen, Powder River Cattle Co.	17	"	600	12.32	329.92
Kelly Creek Ditch	Jno. Burton	18	"	160	3.6	333.52
Blue Gap Ditch	Little North Fork Ditch company	19	"	1500	26.5	360.02
Teddy Miller Ditch	Fred. G. S. Heese	"½	"	1160	84.45	444.47

Fort Collins canal	Fort Collins Land & Improvement Co.	20	Not given.	21000	210.	654.57
North Fork ditch	J. May and C. Covington	"½	"	800	25.	679.47
Devoe Ditch No. 1	H. W. and C. M. Devoe	21	"	2000	60.1	739.57
Devoe Ditch No. 2	H. W. and C. M. Devoe	22	"	3000	78.11	817.68
Kelly Creek ditch	F. M. Canton	23	"	100	10.5	828.18
Thompson Bros. ditch	F. S. and G. F. Thompson	24	"	160	17.3	845.48
Thompson and Matthews ditch	F. S. and G. F. Thompson	25	"	800	12.	857.48
Moreton ditch	F. G. S. Heese	"½	"	4000	45.72	903.20
Mitchell and Lang ditch	B. Lang, M. F. Mitchell	26	"	1200	25.	928.20
Kennedy ditch	C. M. White	"½	"		13.	941.20
Harris ditch No. 2	W. Harris	27	"	100	10.	951.20

WATER DISTRICT NO. 1.

TABLE NO. 4.

Giving the date of appropriation and order of priority, the number of acres watered and the amount of each allotment, in cubic feet per second, for the ditches diverting water from Horse creek; as established by the decree of the court of the first judicial district, dated the 12th day of June, 1888.

NAME OF DITCH.	NAME OF APPROPRIATOR.	Priority Number	DATE OF APPROPRIATION	Number of Acres Watered.	Allotment of water Cu. ft. per sec.	Total volnme of water allotted Cu. ft. per sec.
McLaughlin ditch No. 6	A. and J. McLaughlin	1	May 31, 1874	100	2.61	2.61
Horse creek ditch No. 9	Cheyenne Land and Live Stock Co	2	May 3, 1874	160	2.	4.61
McLaughlin ditch No. 2	A. McLaughlin	3	June 1, 1874	60	4.	8.61
Horse creek ditch No. 5	Cheyenne Land and Live Stock Co	4	May 31, 1875	100	1.95	10.56
Campbell ditch No. 2	Chas. A. Campbell	5	June 1, 1875	60	4.9	15.46
McLaughlin ditch No. 5	A. McLaughlin, et. al	6	June 30, 1875	600	7.	22.46
Horse creek ditch No. 4	Cheyenne Land and Live Stock Co	7	Dec. 31, 1875	80	2.89	25.35
Bay State ditch No. 1	Bay State Live Stock company	8	May 15, 1876	100	2.87	28.22
Bay State ditch No. 2	Bay State Live Stock company	9	May 15, 1876	60	4.9	33.12
Mayer ditch No. 6	Mayer Bros	10	May 31, 1876	60	2.7	35.82
Horse creek ditch No. 8	Cheyenne Land and Live Stock Co	11	May 31, 1876	100	1.68	37.50
Horse creek ditch No. 6	Cheyenne Land and Live Stock Co	12	May 31, 1877	40	1.89	39.39
Horse creek ditch No. 2	Cheyenne Land and Live Stock Co	13	June 30, 1877		3.13	42.52
Mayer ditch No. 5	Mayer Bros	14	April 15, 1878	120	3.20	45.72
Mayer ditch No. 4	Mayer Bros	15	April 20, 1878	120	4.25	49.97
Horse creek ditch No. 7	Cheyenne Land and Live Stock Co	16	May 31, 1878	100	3.4	53.37
Mull ditch No. 1	B. and Mary Mull	17	April 10, 1879	160	8.42	61.79
Snow Cattle Company ditch No 2	Snow Cattle company	18	May 5, 1879	150	10.5	72.29
Horse creek ditch No. [illegible]	Cheyenne Land and Live Stock Co	19	June 30, 1879	50	2	74.29

Snow Cattle Company ditch No. 1	Snow Cattle company	21	May 1, 1880	100	9.6	88.09
Timberline ditch	Cheyenne Land and Live Stock Co	22	May 10, 1880	220	8.5	96.59
Mayer's ditch No. 2	Mayer Bros	23	March 30, 1881	300	5.5	102.09
Snow Cattle Company ditch No. 4	Snow Cattle company	24	May 10, 1881	250	9.98	112.07
Latham ditch	Cheyenne Land and Live Stock Co	25	September 21, 1881	50	6.5	118.57
Horse creek ditch No. 6	Carey company	26	April 1, 1882	500	7.02	125.59
Adamson ditch No 2	Ferguson Land and Cattle company	27	April 15, 1882	385	9.36	134.95
McLaughlin ditch No. 1	A. McLaughlin	28	April 26, 1882	40	5.1	140.05
Collins ditch	Jno. W. Collins	29	April 30, 1882	25	3.95	144.
Campbell ditch No. 1	Charles A. Campbell	30	June 1, 1882	100	3.75	147.75
Horse creek ditch No. 10	*Carey company*	31	*June 1, 1882*	150	12.80	160.55
Dyer ditch No. 1	Timothy Dyer	32	June 15, 1882	200	2.3	162.85
Adamson ditch No. 1	Ferguson Land and Cattle company	33	December 31, 1882	200	8.67	171.52
LeCavilier ditch	Geo. W. Hoyt	34	March 14, 1883	110	1.98	173.50
Rutledge and Hellman ditch	Rutledge and Hellman company	35	March 15, 1883	4840	119.	292.50
Brown and Lagrange ditch	C. M. Lagrange	36	March 23, 1883	600	39.6	332.10
Brown and Lagrange ditch	D. E. Brown	37	March 23, 1883	1200	37.6	369.70
Mayer ditch No. 1	Mayer Bros	38	April 20, 1883	240	6.66	376.36
Horse creek ditch No. 2	Ferguson Land and Cattle company	39	May 1, 1883	50	5.61	381.97
Horse creek ditch No. 3	Ferguson Land and Cattle company	40	May 1, 1883	100	7.2	389.17
Hailey ditch	George Montgomery	41	June 18, 1883	55	5.	394.17
Bamachburn ditch	George Montgomery	42	June 27, 1883	50	8.16	402.33
Horse creek ditch No. 1	Ferguson Land and Cattle company	43	October 31, 1883	295	7.3	409.63
Snow Cattle Company ditch No. 3	Snow Cattle company	44	November 6, 1883	25	7.56	417.19
St. Anno ditch	Donald Clark	45	April 10, 1884	125	8.43	425.62
Calland and Culver ditch	J. W. Collins	46	April 24, 1884	500	24.	449.62
Mayer ditch No. 3	Mayer Bros	47	April 30, 1884	120	4.80	454.42
Lowe Cattle Company ditch No. 1	Marcus M. Mason	48	May 10, 1884	640	15.8	470.22
Carey Horse creek ditch No. 9	Carey company	49	August 15, 1884	50	8.8	479.02
J. H. Gordon ditch	J. H. Gordon Ditch company	50	August 24, 1884	15600	303.177	782.197
Adamson ditch No. 3	Ferguson Land and Cattle company	51	September 1, 1884	50	4.75	786.947
Horse creek ditch No. 1	Goshen Hole Irrigation company	52	September 18, 1884	4500	45.48	832.427
Hog Back ditch	George Montgomery	53	October 8, 1884	9	6.	838.427
McLaughlin ditch No. 3	A. and J. McLaughlin	54	March 20, 1885	80	8.4	846.827
Spy ditch	Thomas M. Herrick	55	April 6, 1885	425	7.20	854.027
Ontario Ditch and Irrigation Co. ditch	Onatrio Water Ditch and Irrigaton Co	56	May 31, 1885	840	15.9	869.927
McLaughlin ditch No. 8	A. McLaughlin	57	June 10, 1885	25	2.	871.927

McLaughlin ditch No 4	A. and J. McLaughlin	58	June 15, 1885	150	2.24	874.167
McLaughlin ditch No. 9	A. McLaughlin	59	June 25, 1885	45	3.	877.167
McLaughlin ditch No. 7	J. and C. McLaughlin	60	September 20, 1885	500	27.	904.167
I. Johnson ditches Nos. 1 and 2	Iver Johnson	61	March 28, 1883	480	9.8	913.967
Carey Horse creek ditch No. 5	Carey company	62	February 1, 1886	200	11.34	925.307
Carey Horse creek ditch No. 4	Carey company	63	March 1, 1886	125	7.85	933.157
Whitehead company's ditch	Whitehead Ditch company	64	April 1, 1886	4000	55.52	988.677
Horse creek ditch No. 3	Ferguson Land and Cattle company	65	May 1, 1886	25	5.61	994.287
Snow Cattle company ditch No. 1	Snow Cattle company	66	May 1, 1886	55	9.60	1003.887
South Horse creek ditch	Cheyenne Land and Live Stock Co	67	May 6, 1886		12.65	1016.537
Carey Horse creek ditch No. 8	Carey company	68	May 15, 1886	190	20.11	1036.647
Nettie ditch	Emma M. Dudley	69	June 1, 1886	80	9.5	1046.147
Brown and Lagrange ditch	D. E. Brown	70	April 1, 1887	400	39.6	1085.747
Herrick and Balcom ditch	T. Herrick, H. Balcom	71	April 1, 1887	90	7.2	1092.947
*Carey Horse creek ditch No. 5	Carey company	72	April 10, 1887	1500	51.37	1144.317
Horse creek ditch No. 2	Goshen Hole Irrigation company	73	June 1, 1887	2000	5.40	1149.717
Horse creee ditch No. 3	Goshen Hole Irrigation company	74	June 1, 1887	250	5.40	1155.117
Horse creek ditch No. 5	Goshen Hole Irrigation company	75	June 1, 1887	200	5.40	1160.517
Horse creek ditch No. 6	Goshen Hole Irrigation company	76	June 1, 1887	300	5.40	1165.917
Mull ditch No. 2	B. P. Mull	77	August 20, 1887	160	4.55	1170.467
Carey Horse creek ditch No. 7	Carey company	78	May 1, 1888	140	7.8	1178.267
Montgomery ditch No. 1	George Montgomery	79	August 1, 1888		5.	1183.267

* Priority No. 72 includes, in both acreage and capacity, priority No. 62.

WATER DISTRICT NO. 1.

TABLE NO. 5.

Giving the date of appropriation and order of priority, the number of acres watered and the amount of each allotment, in cubic feet per second, for the ditches diverting water from Bear Creek; as established by the decree of the court of the first judicial district, dated day of , 18 .

NAME OF DITCH.	NAME OF APPROPRIATOR.	Priority Number	DATE OF APPROPRIATION	Number of Acres Watered.	Allotment of water Cu. ft. per sec.	Total volume of water allotted Cu. ft. per sec.
Not given	Bear Creek Ditch company	1	June 1884	Not given.	14.	14.00
Rugg ditch	Charles F. Rugg	2	November 25, 1884		5.76	19.76
Pioneer ditch	Frank A. Muzzy	3	April 25, 1885		5.33	25.09
P. J. Yoder and H. C. Yoder ditch	P. and H. Yoder	4	May 10, 1886		4.8	29.89
Pioneer ditch No. 2	F. H. Muzzy	5	September 15, 1886			29.89
Not given	Inter-Ocean Hereford Association	6	Spring 1887			29.89

WATER DISTRICT NO. 8.

TABLE NO. 6.

Giving the date of appropriation and order of priority, the number of acres watered and the amount of each allotment, in cubic feet per second, for the ditches diverting water from Crow creek, and its tributaries, viz: North Crow creek, Middle Crow creek, South Crow creek and Clear creek; as established by the decree of the court of the first judicial district, dated the day of 188 .

NAME OF DITCH.	NAME OF APPROPRIATOR.	Priority Number	DATE OF APPROPRIATION	Number of Acres Watered.	Allotment of water Cu. ft. per sec.	Total volume of water allotted Cu. ft. per sec.
Clear Creek ditch E	Warren Live Stock company	1	Not given.	80	1.74	1.74
Clear Creek ditch F	Warren Live Stock company	2	"	160	1.43	3.17
Clear Creek ditch D	Warren Live Stock company	3	"	320	1.32	4.49
Clear Creek ditch A	Warren Live Stock company	4	"	80	1.	5.49
Clear Creek ditch B	Warren Live Stock company	5	"	320	.77	6.26
Clear Creek ditch C	Warren Liue Stock company	6	"	160	1.43	7.69
Duffey ditch No. 1	Jno. H. C. Reese	7	"	160	1.25	8.94
Duffey ditch No. 2	Jno. H. C. Reese	8	"	120	1.56	10.50
Bresnahen ditch	Bresnahen Ditch company	9	"	500		10.50
Duffey ditch No. 3	Jno. H. C. Reese	10	"	80	1.56	12.06
Four certain ditches	Jno. H. C. Reese	11	"	120		12.06

Of 600 streams from which water is diverted the rights of only six have been settled in two years. The scant water supply of the period rendered this a serious evil. The fact that the rights of over nine-tenths of the claimants to water were undetermined greatly restricted the authority and usefulness of both the water commissioner and the engineer. A large part of the work performed was in dividing water for domestic uses where a decree was not necessary, but this work fell far short of what was needed and what must be performed in the near future.

In my report for the year 1888, speaking on this subject, I said:

"The scarcity of water, which prevailed in many localities, made the need of proper distribution unusually urgent. Requests from prior claimants, who were unable to secure their rights, came from all parts of the territory asking for the services of the water commissioner to regulate the division of the water supply. As there were no commissioners to act, and their authority in such cases was doubtful, nothing could be done."

Another difficulty has been encountered in the fact that the decrees rendered do not include all the ditches of the streams. The decree for Crow creek omits twenty-three ditches, that for Bear creek includes only six out of forty-two recorded ditches and this criticism applies to all the other decrees.

An examination of the decrees shows the necessity of securing by legislation or otherwise a definition of the principles governing the appropriations of water. The importance of this question can scarcely be overestimated. The productiveness and value of the land depends almost wholly on its water supply and everything which impairs the validity of the right to this lessens the value of the land and threatens the progress and stability of irrigation. The titles to water, therefore, should be as definite and secure as deeds to land. This is not the case now nor can it be so long as the nature and basis of appropriations are so illy defined and misunderstood. It must be settled, for instance, whether the appropriation is inseparable from the ditch through which it passes or from the land which it reclaims—whether by appropriation there is granted to the individual owning the land or ditch a certain annual volume of water which he can dispose of in any fashion which profit or inclination may dictate, or simply the right to use the water in a definite manner. I shall discuss farther on the reasons justifying the segregation of a public commodity like water to a private use. I. wish now to simply call attention to the fact that a study of the decrees and of the legislation of the past four years shows that we are at sea as to the nature of the proprietary interest acquired by appropriation. In one of the decrees the grant is made to the individual. The decree, while supposedly based upon the rights acquired in the construction of ditches, does not designate them nor does it specify the use to be made of the water. In another, individuals are granted specific volumes of water "*by reason of the construction of ditches.*" The use to which this water is to be applied is not stated and in so far the grant is absolute and unconditional. In a third case the individual, *for constructing the ditch*, which is named, is permitted to have a certain volume of water pass through said ditch for the irrigation of a stated area of land; or in other words, the reason for making the grant is stated and the use to which it may be applied is designated. These three decrees were rendered within a year and under the same law. They represent a remarkable diversity of interpretation, and all in my judgment, fall far short of what is required.

In the first place, I believe that the basing of appropriations on the construction of ditches and making the amount agree with their carrying capacity, regardless of all other considerations, is not in accordance with the provisions of section 14, chapter 55 Session Laws of 1888, which reads as follows: "The priority of of right to the use of water shall be limited and restricted to so much thereof as may be necessarily used and appropriated fo irrigation or other beneficial purposes as aforesaid, *irrespective of the carrying capacity of the ditch.*"

In the second place I do not believe that unconditiona grants of the public water should be made to individuals or corporations. The ownership which such grants confer inevitabl leads to water being made a speculative commodity which fro its nature is should never become, and while as yet we have n resulting abuses, it is simply because of the immense field fo constructing new works and because the necessity has not arise for showing the immense power which the unrestricted ownership of this commodity bestows. The history of all European irrigation countries is fraught with warning of the evils of this policy. Individual ownership of water has led to extortion and abuses, and unless changed, sooner or later ends in anarchy or agricultural prostration. France and Italy both began by allowing individuals to appropriate the water and both have been forced by unhappy experience to adopt either appropriation by the land or ownership and control by the state. In Spain, where the land appropriates the water, the people have been for hundreds of years contented and prosperous, while in those districts where individuals gained control of the water supply agriculture languishes, and the people, suffering from repeated exactions, have lost all their enterprise and thrift.

If in the future allotments should be governed by the principle of making rights to water inhere in the land, this will of necessity do away with the procedure of basing the amount of appropriations on the carrying capacity of ditches, measured as a rule at or near the head gate. The absurd allotments which sometimes result from this should of themselves to be sufficient argument for such change. In one decree six cubic feet per second is appropriated to a ditch watering nine acres of land. This, in an irrigating season of one hundred days, would cover the ground to a depth of 147 feet. In the same decree 2,000 acres receive five cubic feet while a ditch watering 200 acres has a grant of twenty cubic feet, or one acre under the latter has allotted to it forty times as much water as an acre under the first named. By simply giving his ditch liberal dimensions one individual obtains forty times as much water as another, the use being the same. Many similar illustrations might be given, since the decrees have not attempted to consider the requirements of the lands watered. Whether or not this is a satisfactory procedure depends entirely on whether or not the building of a ditch is the sole condition on which appropriations should be based. If it is, then the decree should allot the full capacity of the ditch regardless of the quantity of land it supplies. Those who object to appropriations to ditches or the owners, maintain that water cannot be appropriated except for beneficial uses; that taken of itself, its diversion into a ditch serves no useful purpose and is not utilization, but waste; that the complete appropriation under the meaning of our law is not accomplished until the water is actually used in reclaiming the land and that if such is the case the amount of the appropriation should not be based upon the size of the ditch which carries it, but on the reasonable requirements of the land reclaimed. It is further urged in behalf of the latter view that if the doctrine of priority of appropriation to beneficial uses is correct, its benefits and protection should be bestowed on the farmer at least in equal measure with the ditch owner, and that to do this it is necessary there should be priorities between farms. In the case of large canals this means priorities under the same ditch, as well as between different ditches on the same stream.

If provision could be made whereby the best land could be set apart for reclamation, and the water appropriated to that land, it would greatly simplify the problem of making the best use of the water, as it would remove the risk in the construction of large ditches, which is caused by the liability of having all the water appropriated by small enterprises before the larger ones can be completed.

One evil is, however, very rarely cured by the commission of a second, and I am led to believe, both because of their abstract justice from the workings of our own system and those of other irrigation states that the following principles should be regarded in the settlement of water rights:

First. That as ditches must of necessity precede agriculture, the date of beginning ditch construction should be the date of priority for all land reclaimed within a certain period after the completion of the ditch, and this time should vary with the magnitude of the work and the difficulties of construction. That is, more time should be given for a ditch ten miles long to water ten thousand acres than for a ditch two miles long to water a section.

Second. That the extent of grants should be limited to the reasonable requirements of the land and not measured by the capacity of the ditch.

Third. That there should be no ownership in water except by the state. The right to its use for any legitimate purpose should, however, be fully guaranteed and protected. In irrigation it should inhere in the land, the right to water for the same being made perpetual so that water rights may go with land titles.

I am persuaded that the adoption of these principles would do much to allay future difficulties and would not menace any legitimate interest. To bring them into successful operation would require some changes in our present laws. These will be spoken of in the succeeding portion of this report.

CONSTITUTION.

ARTICLE NO. VIII.—IRRIGATION AND WATER RIGHTS.

SECTION 1. The water of all natural streams, springs, lakes or other collection of still water, within the boundaries of the State, are hereby declared to be the property of the State.

SEC. 2. There shall be constituted a board of control, to be composed of the state engineer and superintendents of the water divisions; which shall under such regulations as may be prescribed by law, have the supervision of the waters of the state and of their appropriation, distribution and diversion and of the various officers connected therewith. Its decisions to be subject to review by the courts of the state.

SEC. 3. Priority of appropriation for beneficial uses shall give the better right. No appropriation shall be denied except when such denial is demanded by the public interests.

SEC. 4. The legislature shall by law divide the State into four (4) water divisions and provide for the appointment of superintendents thereof.

SEC. 5. There shall be a state engineer who shall be appointed by the governor of the State and confirmed by the senate; he shall hold his office for a term of six (6) years or until his successor shall have been appointed and shall have qualified. He shall be president of the board of control and shall have general supervision of the waters of the State and of the officers connected with its distribution. No person shall be appointed to this position who has not such theoretical knowledge and such practical experience and skill as shall fit him for the position.

RECOMMENDATIONS.

CHANGES NEEDED FOR THE IMPROVEMENT OF OUR SYSTEM,
POWERS AND DUTIES OF THE BOARD OF CONTROL.
STATEMENT OF THE NEEDS OF THE
ENGINEER'S OFFICE, ETC.

One of the important duties which the law requires the engineer to perform is recommending needed changes and improvements in the water right laws. In this work I have been aided by the labors of the recent constitutional convention. Irrigation was given important consideration by that body and the provisions adopted have not only been ratified by the people o the territory, but warmly commended by irrigation authorities and others elsewhere. They may, therefore, be taken as no only reflecting the results of the thought and experience of this territory, but also of a large part of the arid region.

These facts alone would entitle the provisions to first consideration in the enactment of new laws, but when there is added the probability that in a few months there will be an organic law on this subject, there would seem to be no question but that the first step in legislation should be to enact laws to put these general principles into effective operation. It is furthermore important that if the measures proposed are to be adopted they should take effect at the earliest possible moment. They are broad in scope and intended to meet the requirements of the future as well as present emergencies. They are a radical departure from present laws and it is only by their early adoption that serious complications can be averted. Believing that the proposed measures are urgently required and that they will do much to simplify, cheapen and render stable the management o the public water supply, I submit the following suggestions as to the legislation needed to make them effective.

BOARD OF CONTROL.

The most important section is that creating a board of control, by which the settlement of water right questions is taken out of the courts and vested in officers who make them a subject of special study, and who, as the responsible supervisors of the work, must of necessity exercise great care and rare judgment in making decisions. Provision for the board of control is a marked innovation in legislation in this country but is the approved plan in all the older irrigation states, and has received only favorable comment from irrigation authorities here. It is further proposed to make each of the four members of this board, outside of the president, superintendent of an irrigation district, the territory being divided by drainage lines into four such districts. In the following I have given the boundaries of these divisions being a repetition of the description of the natural divisions given in a preceding portion of this report and an outline of what, in my judgment, should be the duties of these officers.

WATER DIVISIONS.

Division number one comprises the North Platte river and all tributaries of the North and South Platte rivers within this territory.

Division number two comprises all tributaries of the Missouri and Yellowstone rivers north of the North Platte river and tributaries, and east of the Big Horn mountains.

Division number three comprises Big Horn river and its tributaries.

Division number four comprises Snake, Bear and Green rivers and their tributaries.

By reference to the map it will be seen that these divisions are compact, and that each of the four have very nearly the same extent. They are completely independent of each other as they are bounded by water sheds.

DIVISION SUPERINTENDENTS.

In the distribution of the water in each of these divisions the superintendent should have immediate control, under the general direction of the territorial engineer. This need not materially change the present laws defining the duties of water commissioners, although it will require redistricting. Owing to the small number of water right priorities now determined there is but little work in the way of dividing water for either superintendents or commissioners, except in one district. The chief, if not exclusive labor of the superintendents for a few years would be in connection with the work of the board of control in the settlement of priorities.

DETERMINATION OF PRIORITIES.

The need of some prompt and effective means for the settlement of claims to the prior right to the public waters can be understood from the statement that there are nearly three thousand ditches with unadjudicated rights now using water. The water commissioners of every district were called out this year, yet in only three instances had they any authority to divide water for irrigation. Decrees have only issued as to six streams. This state of affairs cannot long continue. The extension of the irrigated territory each year makes the need of the settlement of water rights imperative. The proper settlement of these questions requires a painstaking examination of the testimony showing the date of appropriation, of the works built and of the character and extent of the water supply. Much of this work can only be properly performed during the summer months, so that if begun now it will be several years before all the claims at present of record can be examined and proper allotments made.

PROCEDURE.

In the settlement of water rights I believe there should be an examination of both the irrigated lands and measurements of the water supply, and if this work is to be performed by the board of control it can be divided between the different division superintendents and the territorial engineer. The superintendents could secure testimony showing the date and amount of the appropriation, and the engineer could make gaugings of the streams and measurements of the distributing works. By arranging a program for the season's work which would include the streams of each division where a settlement is most needed, much can be accomplished during a season at a comparatively small expenditure of time on the part of all except the engineer or his deputy. By doing this and by giving a public notice in advance of the date of such examination the convenience of claimants will be served and the facts as to the utilization of the water obtained.

The board of control should have at least one meeting each year, at which time the evidence obtained as to appropriations on streams examined should be considered and determination of priorities made. All awards should be subject to review by the proper court, good cause being shown; but the time of taking appeal should be limited.

By such procedure I believe these improvements over the present methods will be secured:

First. Allotments will not, as at present, be based on *ex-parte* testimony, but on reports of personal examinations by competent and disinterested officials.

Second. Gain of time in the settlement of pending controversies.

Third. Relief to the users of water from exorbitant fees which they now pay.

FUTURE DISPOSAL OF THE PUBLIC WATERS.

PRELIMINARY STATEMENT.

In the preceding recommendations I have dealt entirely with the settlement of priorities growing out of ditches already built. There yet remains to be settled the policy to be pursued by the government in the regulation of future appropriations. That the present laws need amendment is almost universally admitted. Some of their defects have been referred to in this report in connection with the difficulty encountered in obtaining ditch building statistics. The fundamental objection is that the present system makes state ownership of water simply a fiction. No supervision is exercised over its diversion nor over the claims of appropriation. The theory has apparently been that whoever first laid claim to the waters of a stream acquired therein unrestricted ownership. This is shown in the absence of any supervision or approval being required when filing claims, in the extravagant character of many of those recorded and in the views of citizens who are familiar with the law. As illustrations I may state that claims are recorded which gravely recite that individuals have appropriated all the waters of both Green and Snake rivers, two of the largest streams in the territory, and that a letter came to this office during the present year complaining that an individual who had neither lands nor ditches had obtained a monopoly of all the water of a certain district by filing claims on the streams. The prevalence of such ideas is an evidence that the theory of state ownership of water is not generally understood. There is, unfortunately, no practical means provided in our laws for applying the theory.

STATE OWNERSHIP.

If state ownership is to be anything but a delusion, if it is to be more than nominal, there must be the same authority and control over streams and over diversion of water as is now exercised by the general government over the occupation and settlement of public lands. No diversion or appropriation should be permitted, therefore, until the sanction of the territory, through its constituted authorities has been obtained, and the beneficial character of the proposed use established. Such oversight and precaution is necessary for the proper protection of public interests (public water supply being of greater agricultural value than public lands) and in order that controversies growing out of extravagant and injurious claims may be avoided.

Instead of the present absence of supervision over either the nature of the diversion and use or the amount of the claim, I would recommend that each and every intending appropriator be required to make application to the irrigation authorities for a permit to divert and use the public waters and that approval of such authorities must be had before work is begun. For convenience in recording, and as a matter of economy, I would recommend that all such applications be made to the territorial engineer.

NATURE OF THE APPLICATION.

This application should specify the location and nature of the proposed distributing works, amount of water proposed to be utilized, purpose to which it is to be applied and any additional facts which may be required to show that the enterprise is a meritorious one. It should be accompanied by a map or plat showing the location of the works for diversion and if the water is for irrigation, the land on which it will be applied.

On receipt of this application, which may be of form prescribed by law or furnished by the engineer's office, it should be the duty of the engineer to examine it for completeness and learn if there is anything in the proposed use of the water which might be detrimental to public interests. If it is satisfactory record should be made of its receipt and a copy filed in his office and a duplicate, showing the date of receipt and approval by the engineer, returned to the applicant, whom it serves as a license for his guidance and protection in future work. The conditions governing the actions of the engineer may be prescribed by law or prepared by the board of control, the important feature to be that all actions shall be based on fixed rules or principles, as is now the case with the entries of public lands.

With each license to divert water there should be conditions stipulating the nature of the proposed use and limiting the time for the completion of work, and on receipt of proof of compliance with these conditions a final certificate of appropriation should be issued corresponding exactly to a land patent. All of these transactions should be made of record in the engineer's office, but only the final certificate need be recorded with the county clerk.

When the proposed diversion is regarded as detrimental to the public interests, approval of the application should be withheld until the case is considered by the board of control, which body shall have the authority to approve or reject.

REFUSAL OF APPLICATIONS.

The policy of the territory refusing permission under any circumstances to divert the public water has been seriously questioned, but a brief acquaintance with the evils growing out of over appropriation will dispel that objection. Every ditch built in excess ot the capacity of a stream means one of two things, either it will be a useless and losing investment or those entitled to water will be robbed thereby, and as a rule it results, to a certain extent in both. Nor should ditches be permitted to carry water where the diversion is against the public welfare, as is the case with some ditches now constructed. A large part of the productive wealth of this territory is in our grazing lands and the water supply which makes them available should be as carefully protected and permanently secured to these lands as to lands reclaimed by irrigation; if not done their abandonment must follow. I, believe, therefore, that the ultimate benefits to be derived from the use of our public waters will as largely depend on restraining injudicious diversion as in permitting appropriations which are beneficial, and that the duty of the government is as much involved in one as in the other.

EXPENSES.

In changes of so radical a character as those proposed the question of expense will doubtless be carefully considered. While I have urged the changes because of the increase in efficiency rather than because of economy, I am fully convinced that reform will result in a great saving.

The new system will abolish the excessive fees which now beset the user of water in his transactions with three or four disconnected officials, and will by simplification of methods, greatly lessen the time required in the settlement and protection of rights. The increase of labor and expense will be chiefly in the engineer's office. Examination and recording of claims and the investigations connected with adjudications will require continuous clerical assistance in the office, and engineering aid in the field during a portion of the year. The increase in expenses can be provided for by fees now exacted in the county clerk's office, or an appropriation can be made for salraies and the fees turned over to the territory. I favor the latter as more economical for the territory and as being correct in principle.

Salaries of all division superintendents will be much less than the court expenses attending adjudication of priorities at present. This outlay is now in fees and the burden falls on the irrigationists alone. I regard this as unjust, and whatever arrangement is made as to fees I believe that officials should receive only a fixed salary and this for the superintendents should be a stated sum per day for the time employed rather than an annual salary, the reason being that at present the greater part of the work will fall in two divisions.

WATER FOR STOCK.

Some provision should be made by which sufficient water will be kept in streams to supply the needs of stock grazing upon the public lands. During the past two years several complaints have come to this office of streams being entirely dry and of great resulting hardship The law touching domestic use does not cover range animals and there was no remedy. I think further that the law making domestic use a preferred priority should be repealed and that all beneficial uses, whether for household purposes, irrigation, mining, manufacturing or watering stock, should stand on the same basis.

ADDITIONAL RECOMMENDATIONS.

There are some minor matters which demand the attention of the legislature, the first being

DAMS IN STREAMS.

In the report of the water commissioners of districts Nos. 1 and 2 reference is made to the construction of dams which are built in such a way as to interfere with the proper division of the water. Some of these dams obstruct the flow and by raising the level of the stream to large bodies of land by sub-irrigation, they in this way greatly reduce the supply belonging to prior approrpiators. This should not be permitted; and all dams should be provided with a wasteway which will permit an unobstructed passage of the water. At the same time the provisions of section 3894, Revised Statutes, are too rigid and would if enforced prevent the construction of dams entirely. I believe that the law should be revised so that all plans for dams should be subject to the approval of the engineer or water commissioner. Section 1355, Revised Statutes, forbids the construction of a reservoir embankment across the channel of any running water. I can see no objection to such structures being built provided they are subject to proper inspection to insure their safety.

HEAD GATES.

It will be noticed that several water commissioners state that much trouble has occurred from the absence of head gates. Without these it is almost impossible to prevent the theft of water by dishonest persons. It should be required, therefore, that all ditches, on streams where an adjudication of priorities has been had, should be provided with head gates which can be closed and locked until permission to open is given by the water commissioner.

TIME OF SERVICE OF WATER COMMISSIONER.

The present law limits the period of service of the water commissioner to fifty days. In many cases this is too short a period and I would recommend that provision be made for its extension by the county commissioners. Some provision should also be made for paying the traveling expenses of the commissioners.